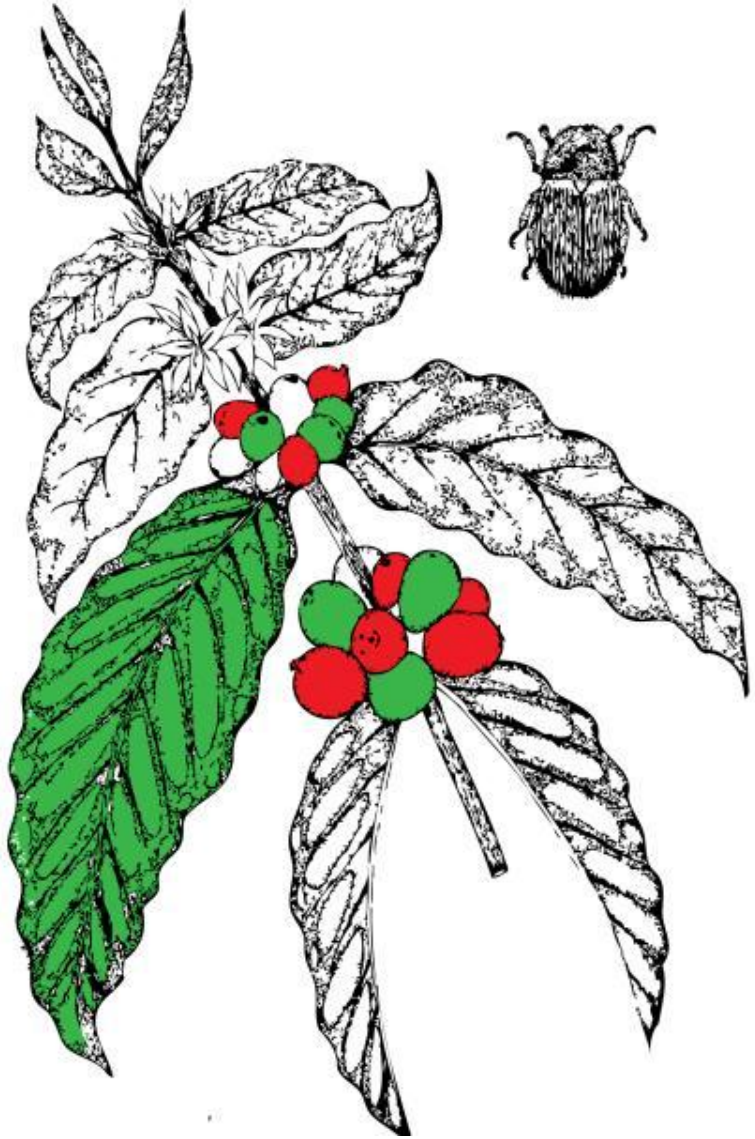


From Africa…

with love

Juliana Jaramillo
James Harwood

icipe
African Insect Science for Food and Health

Leibniz Universität Hannover

USDA United States Department of Agriculture

Email: jjaramillo@icipe.org;

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?

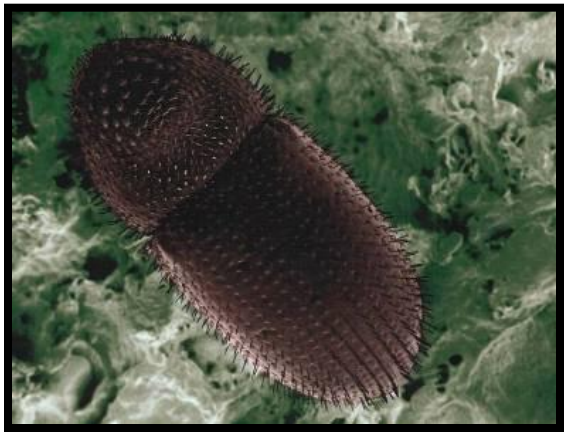
80 countries cultivate coffee (exported to >165 countries)

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

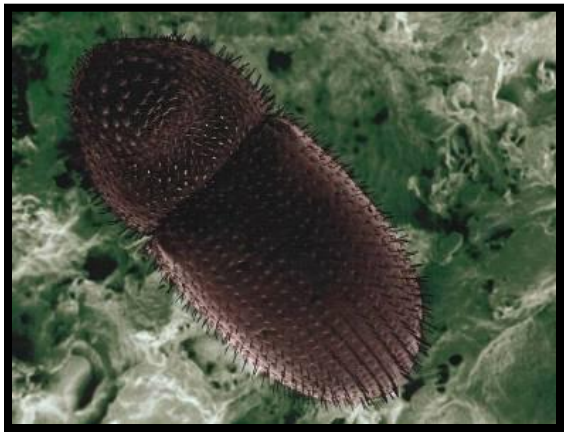
Climate change / climate variability:

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

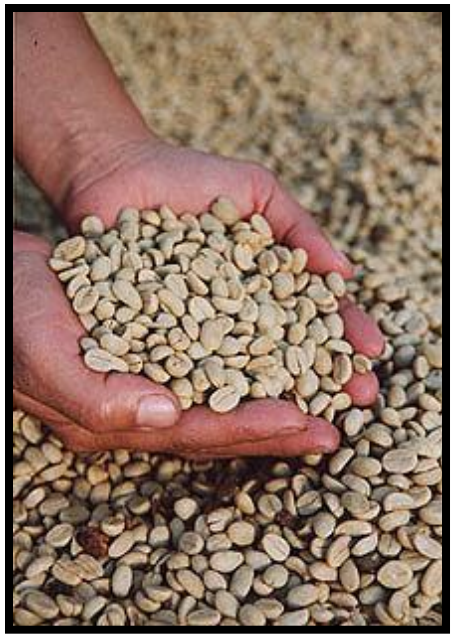
High reproductive & survival potential

Insecticide resistance

Pest and its system still poorly understood

The Coffee Berry Borer

The losses



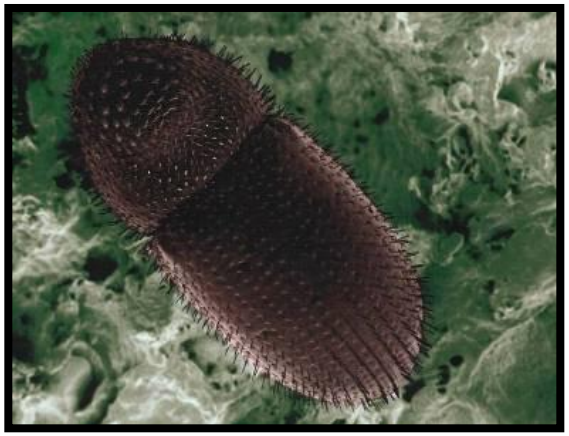
Without interventions, infestation levels up to 90%

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?



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 or mitigation strategies?

Working in Africa

Centre of origin – co-evolution

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

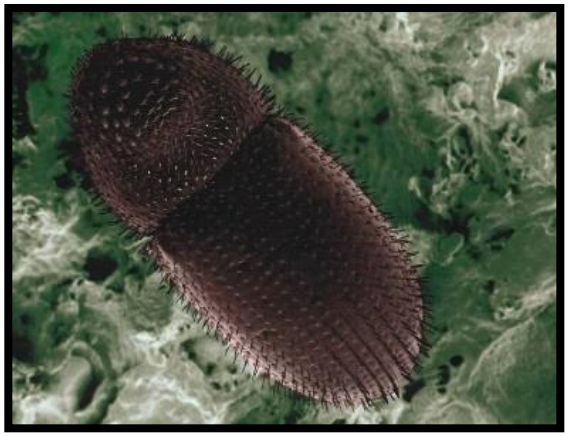
Possibly, natural enemies one important factor

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

What are other factors?

The answers in Africa?

What are we doing?



Coffee berry borer

- Chemical ecology of the coffee berry borer

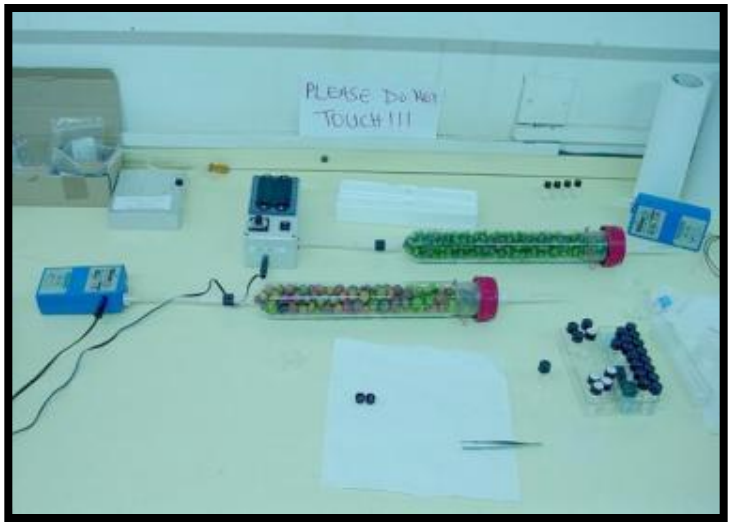
- Pursuing classical biological control through search of new natural enemies

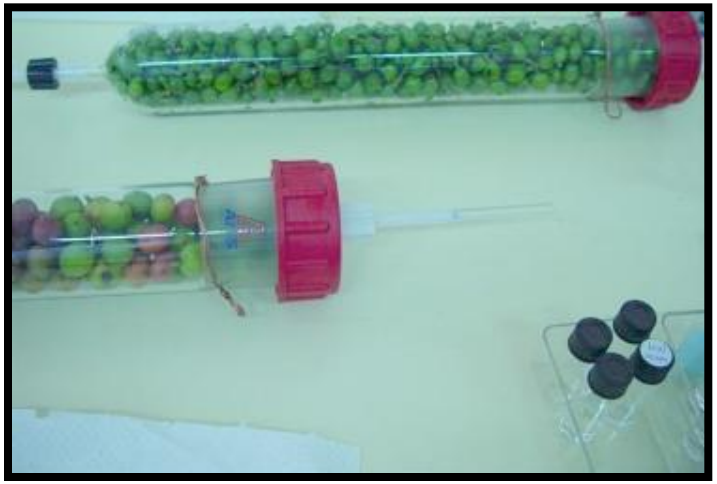
Climate change & coffee berry borer

- What would be adaptation and mitigation strategies?

Chemical ecology of the coffee berry borer

Chemical ecology of the coffee berry borer



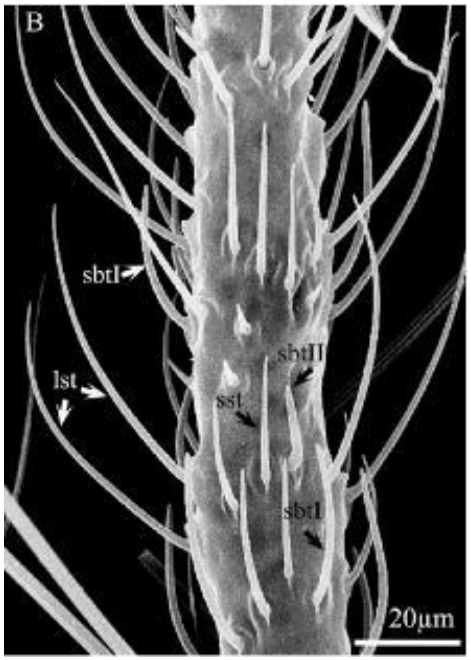


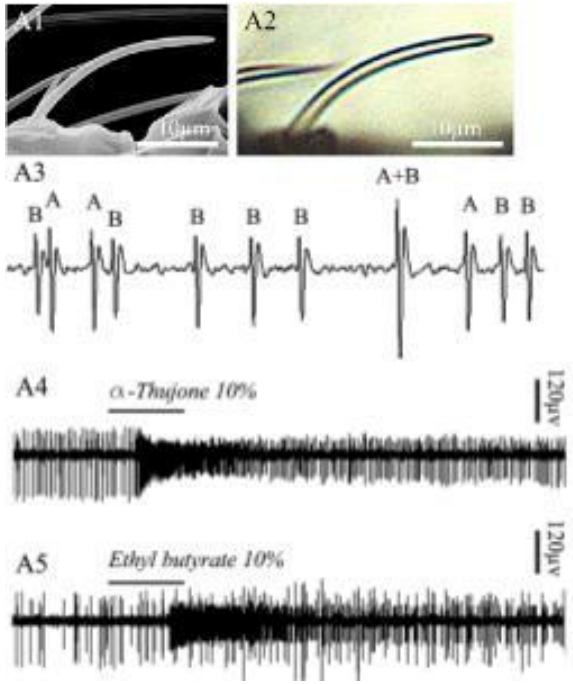
Neuroethology

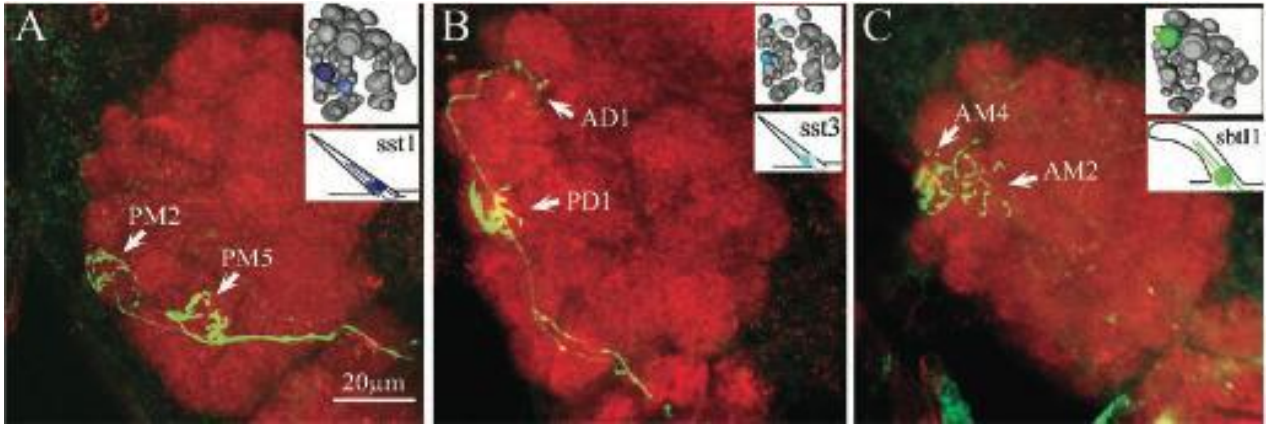
Max Planck Institute
for Chemical Ecology

MAX-PLANCK-GESELLSCHAFT

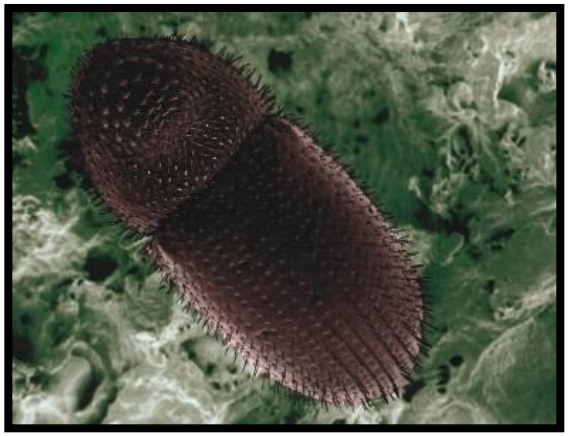
icipe
African Insect Science for Food and Health







What are we doing?



Coffee berry borer

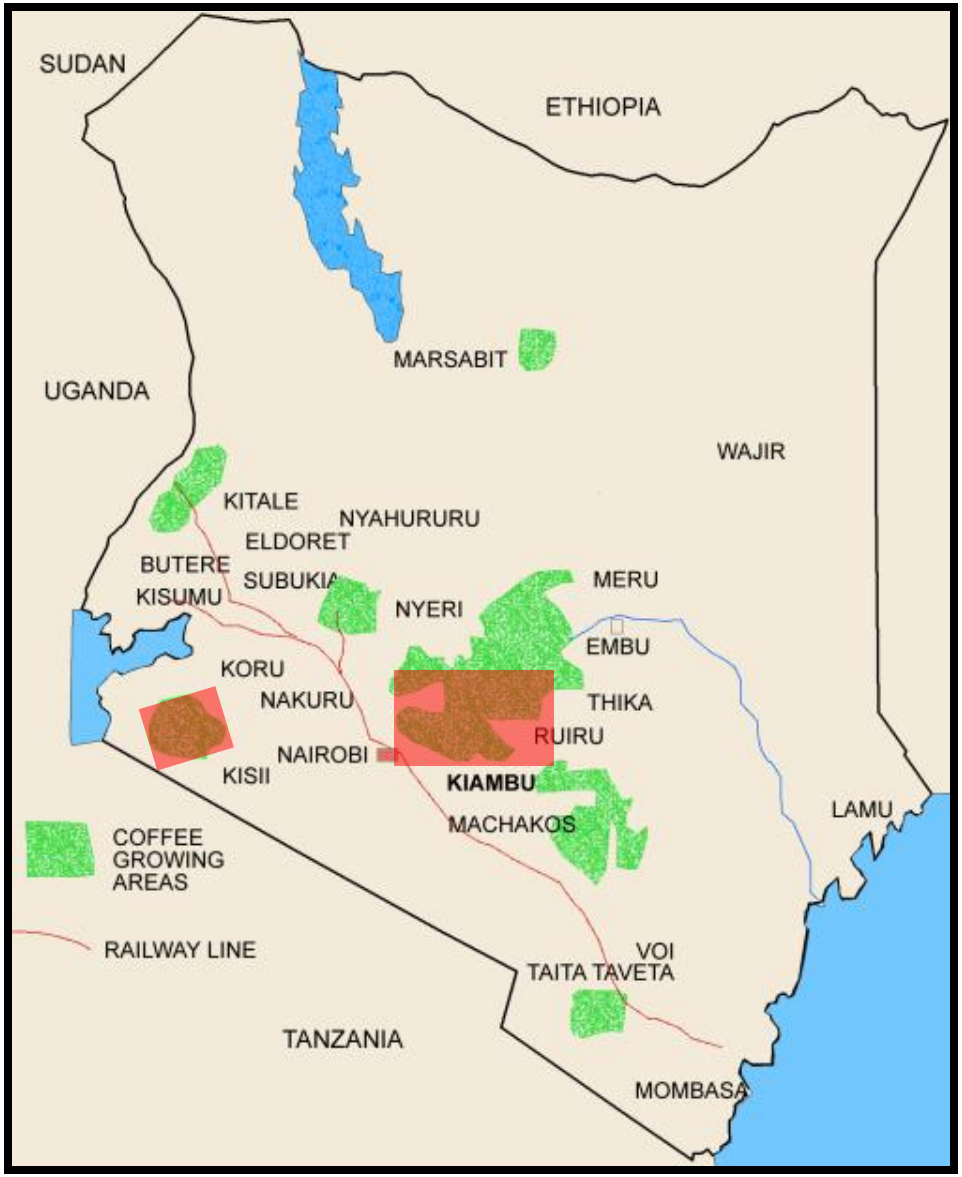
- Chemical ecology of the coffee berry borer

- Pursuing classical biological control through search of new natural enemies

Climate change & coffee berry borer

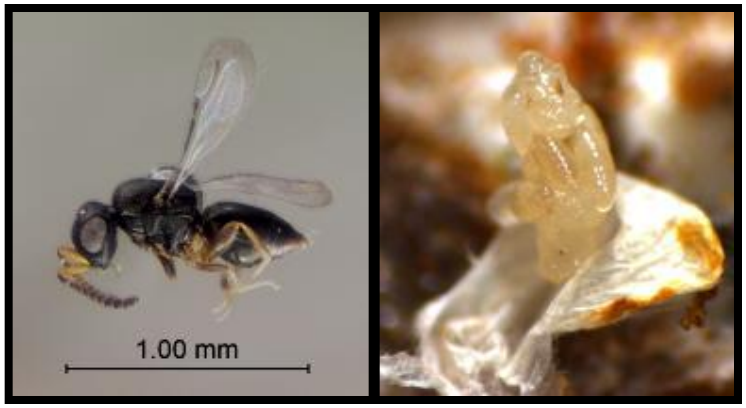
- What would be adaptation and mitigation strategies?

Sampling areas



Sampling 2006-2010

It is worth looking for new natural enemies



Aphanogmus sp.

Hyperparsitoid of *Prorops nasuta* in western Kenya

AND a predator of coffee berry borer

Karnyothrips flavipes

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

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

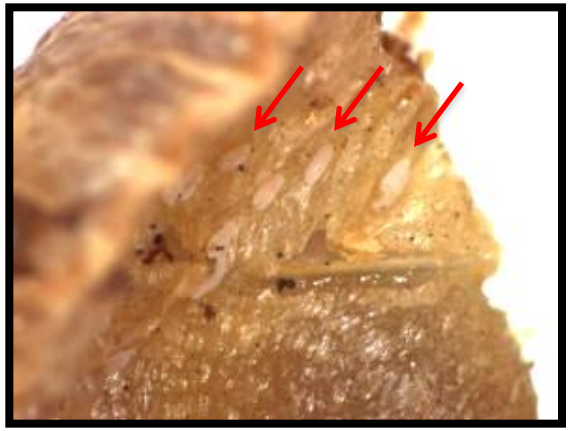
First report in Africa

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

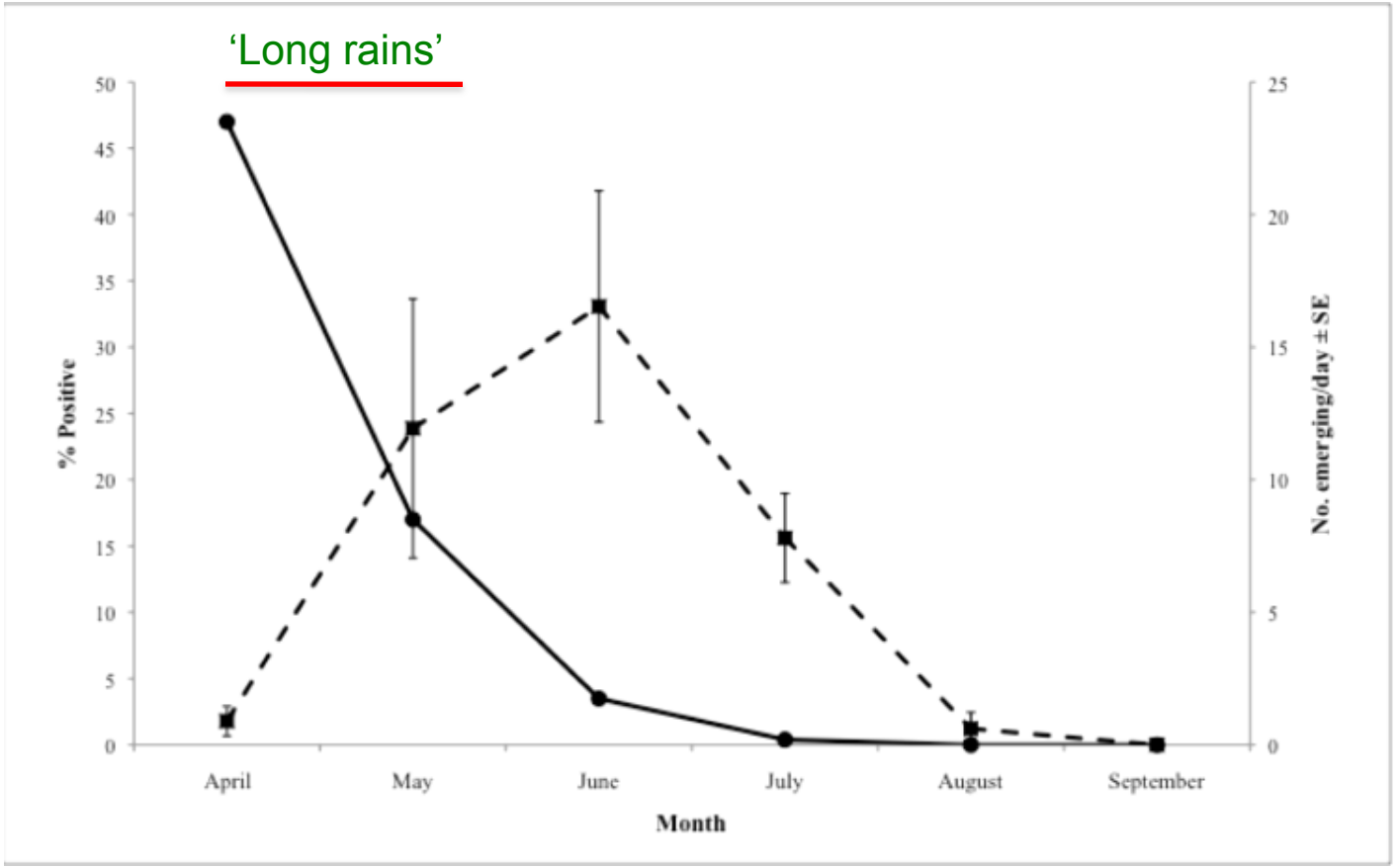
Karnyothrips flavipes



Jaramillo, Chapman, Vega, Harwood, 2010

A predator of the coffee berry borer

Karnyothrips flavipes

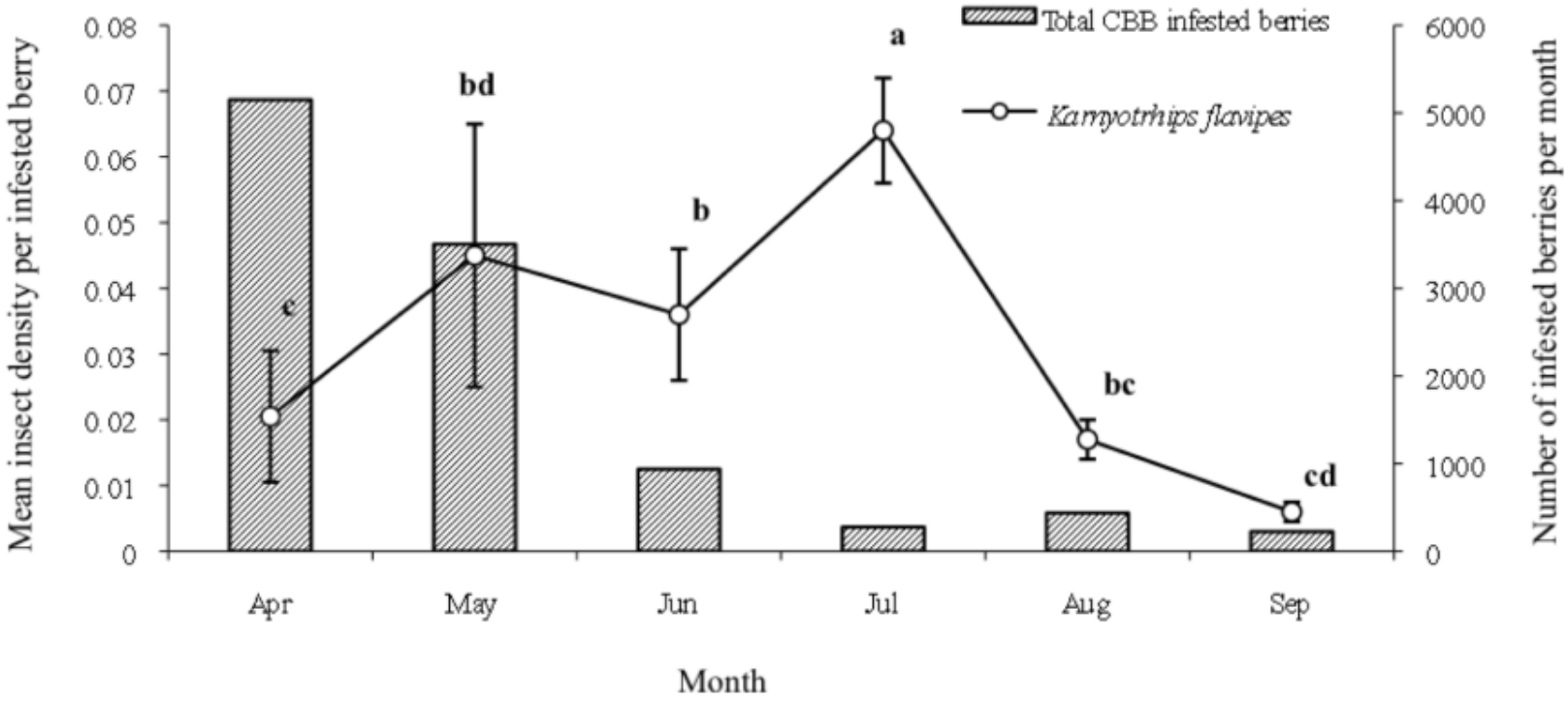


Temporal relationship between emergence of predators and feeding activity upon *H. hampei*. Solid line: percent of predators positive for *H. hampei* DNA; dashed line: mean number of thrips (± SE).

Jaramillo, Chapman, Vega, Harwood, 2010

A predator of the coffee berry borer

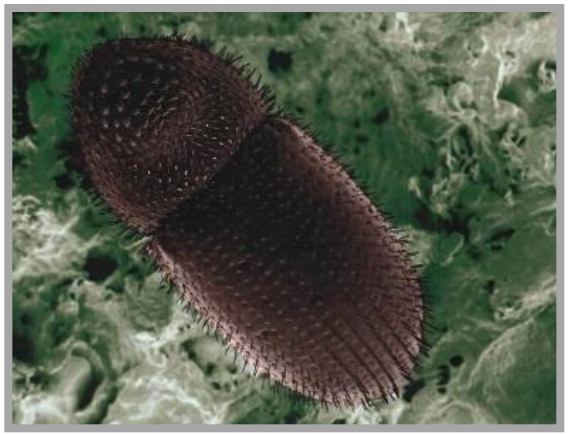
Karnyothrips flavipes



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?

Climate change & coffee berry borer

Adaptation strategies

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

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

Introduction of shade trees in coffee plantations might alleviate negative effects of climate change on coffee production

Jaramillo et al., 2009

Climate change & coffee berry borer

Adaptation strategies

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

Decrease in the temperature by:

Ca. 4° C under low altitude conditions

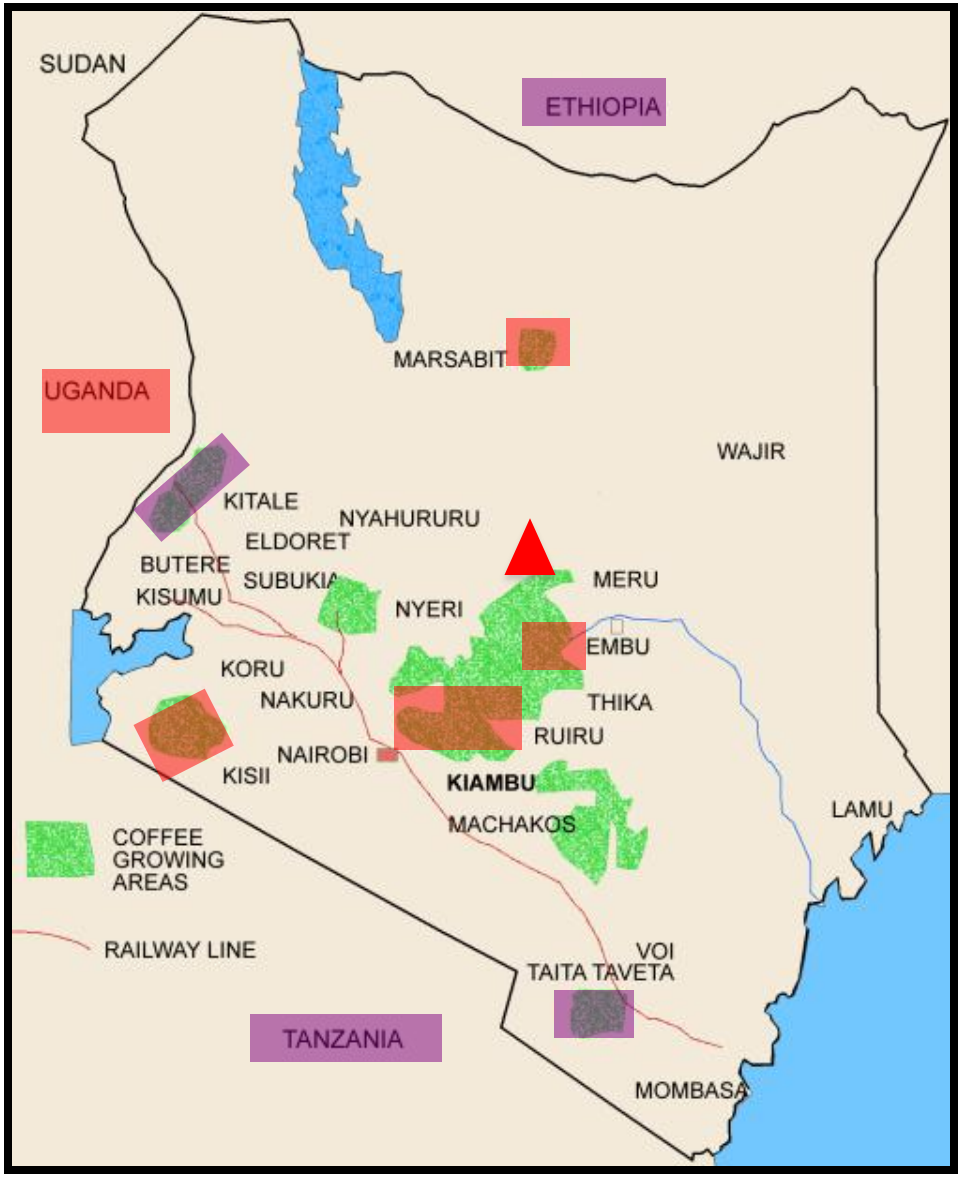
Ca. 2° C under mid to high altitude conditions

Shaded coffee plantations in Central America and East Africa: reduction in temperature between 2–6° C, compared to coffee grown without shade

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)

Conclusions

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

Acknowledgements

German Research Foundation – DFG

International Centre of Insect Physiology and Ecology – *icipe*

Taxonomists at the Systematic Entomology Laboratory (USDA, ARS)

Fernando E. Vega (USDA, ARS)

Steve Nakahara (USDA, ARS)

Charles Kamonjo (Icipe)

Adenirin Chabi-Olaye (RIP) (Icipe)

James D. Harwood & Eric Chapman (University of Kentucky)

Fotos:
CENICAFE
Georg Georgen (IITA)
USDA, ARS
Fernando E. Vega
Juliana Jaramillo

FROM AFRICA… WITH LOVE

THANK YOU