SAFE CONTROL OF MIRID PESTS ON COCOA IN WEST AFRICA

The Potential for Biopesticides

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The Project

- A Joint Programme between Cocoa Research UK (CRUK) and Cocoa Research Institute of Ghana (CRIG)
- Need for alternatives to chemical insecticides currently in use
  - Compliance to International Residue Limitations
  - Operator Risk
  - Resistance Management

Objectives

- development of better screening methods and laboratory-to-field procedures for assessing more slow-acting chemical and biological agents
- introduction of better pesticide application practices in the country-wide insecticide spraying programme
- identification and proof of concept of one or more isolates – for eventual development of a mycoinsecticide

The Pests

Sahlbergella singularis – Adult and late instar nymph

The Pests

Distantiella theobromae – Adult and 3rd instar

Additional Minor Heteropteran Pests

Helopeltis sp.

Additional Minor Heteropteran Pests

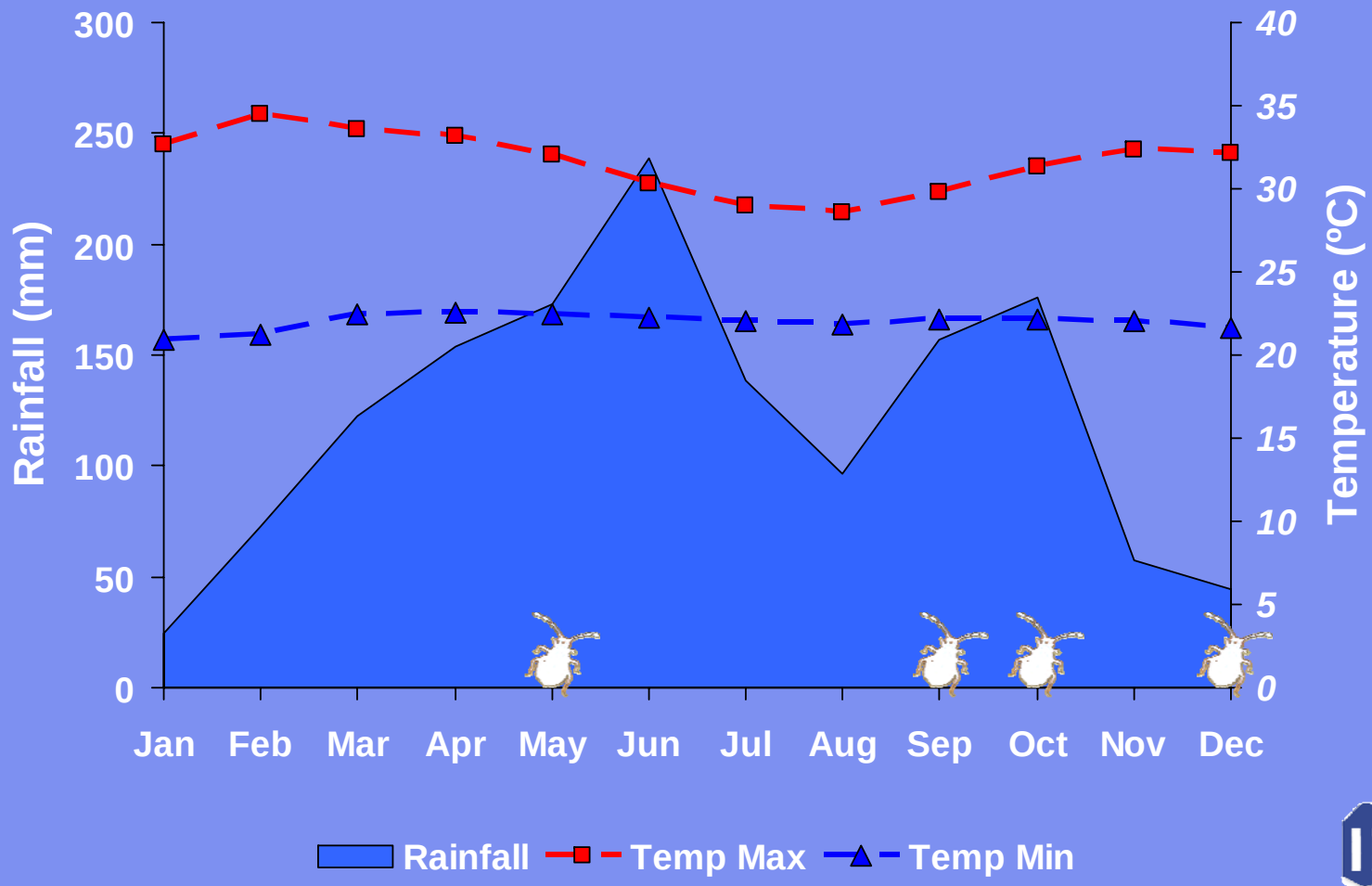
Bathycoelia thalassina

Economic Importance

- Estimated at 25-30% of current acreage is affected by mirid activity in Ghana
- This results in approximately 100,000 tonnes in yield loss in Ghana alone
- The annual value of Ghanaian cocoa exceeds US$1 Billion

Mirid Damage

Historical Climate Data from CRIG
(1986-2006)



Isolate Screening and Characterisation

- Bioassay
- Enzyme Analysis
  - Type III Chitinase Activity
  - Lipase Activity
- Rate of Growth
- Sporulation
- Thermal tolerance
- Stability: capacity to remain viable and virulent
- Effects of passage

Bioassay

- Use of *Dysdercus fasciatus* as surrogate insect (alternative *Dysdercus sp*. in Ghana)
- Protocol for assay method designed to minimise control mortality
- Comparison of topical and secondary pick-up bioassay methods

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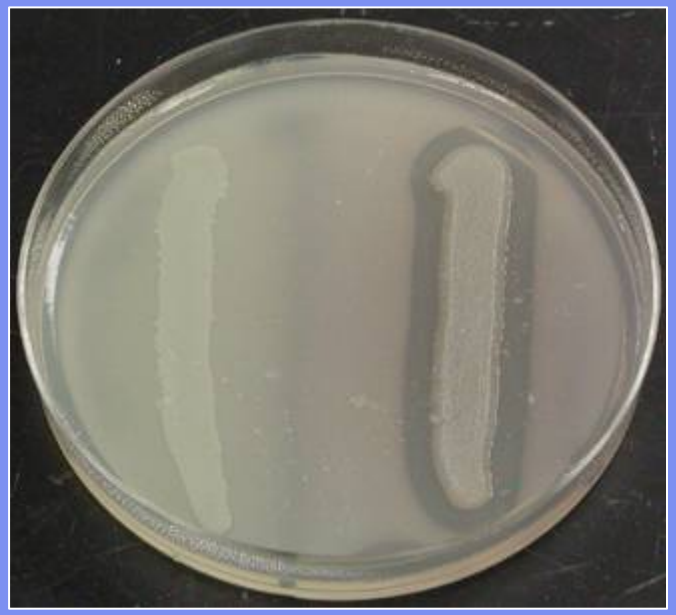
Enzyme Analysis - Lipase

- Lipase allows the organisms that produce it to break down lipids into smaller fragments
- Linked with germination of entomo-pathogenic fungi on host as well as spread of infection
- Tributyrin agar is a differential medium that tests the ability of an organism to produce lipase
- A clear ‘halo’ forms around areas where a lipase-producing organisms has grown
- Possibility of using lipase standards to produce quantifiable data



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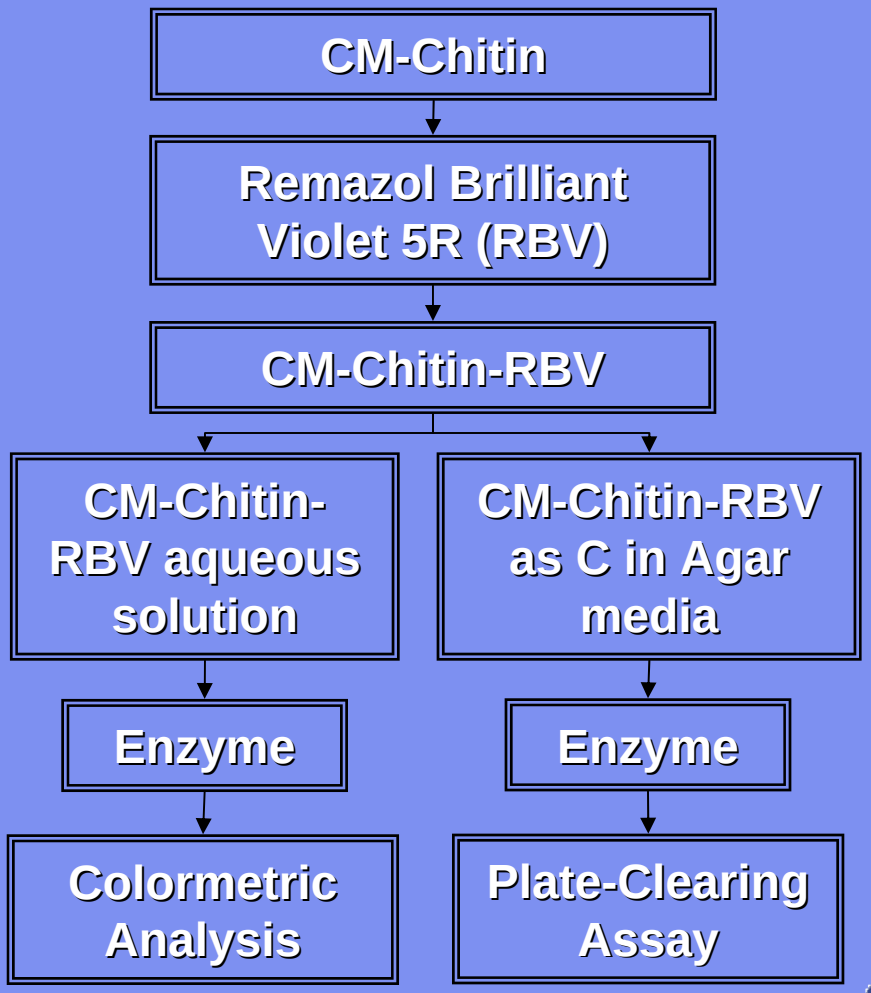
Enzyme Analysis – Type III Chitinase

- Insect Cuticle made up of chitin matrix
- Evidence that high levels of Type III chitinase can increase infection rates and decrease time till death shown using an over-expression of an engineered chitinase (23% Reduction in time until death)
- Option of producing qualitative data via plate-clearing assay or quantitative data using colorimetric analysis



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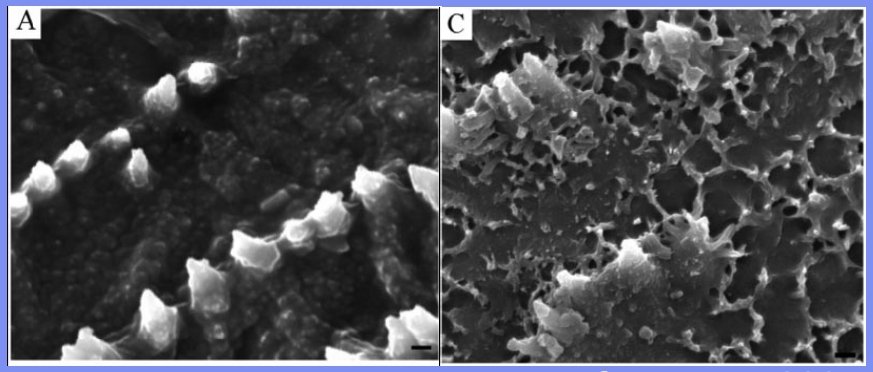
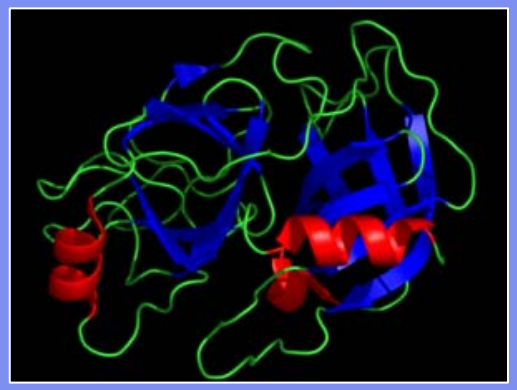
Future Enzyme Study



Images from Wan 2007

- Possibility of further molecular analysis of isolates
- BbChit1 and BbChit2 already identified – others?
- Additional enzymes that might aid infection include:
  - Beauvericin – a depsipeptide
  - Destruxins – a group of cyclodepsipeptides
  - Pr1 – a chymoelastase
  - Pr2 – a trypsin
- Possible Collaborations?



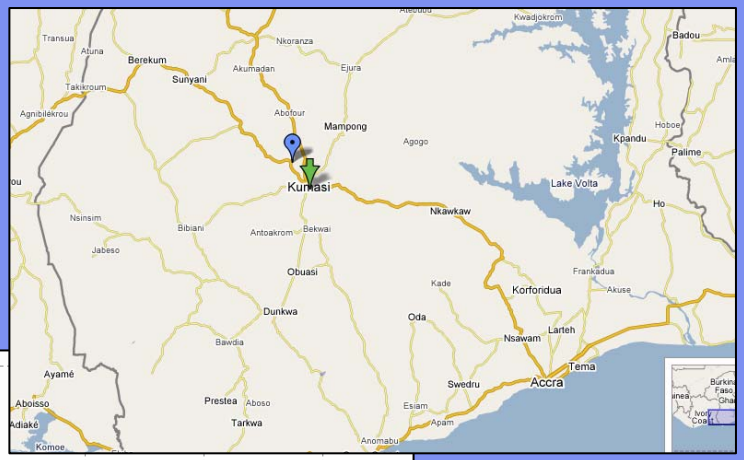
Trypsin

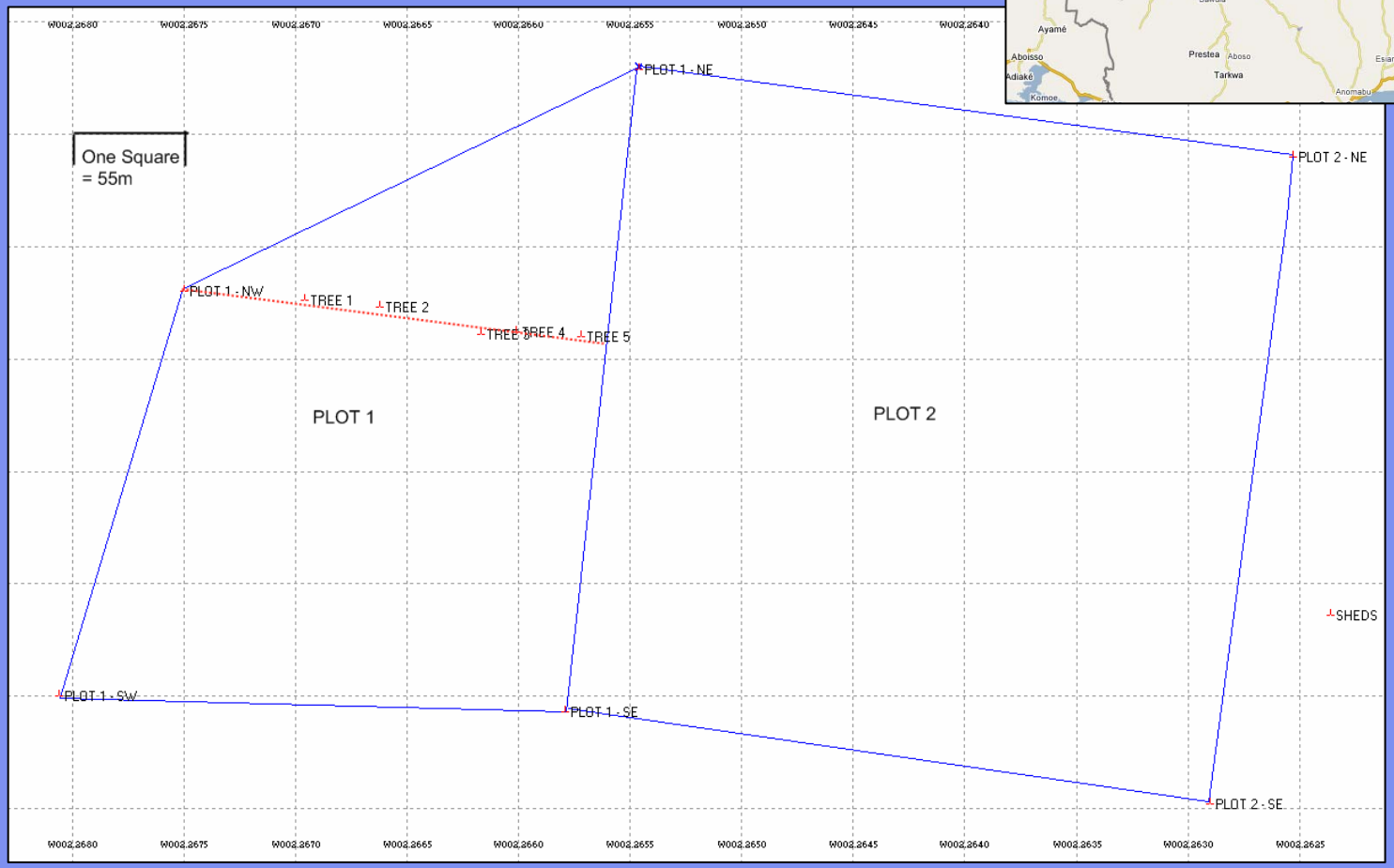
Isolate Screening and Characterisation

- Bioassay
- Enzyme Analysis
  - Type III Chitinase Activity
  - Lipase Activity
- Rate of Growth
  - Agar Plug transfer
- Sporulation
  - Spore yield from known concentrations
- Thermal tolerance
  - Blanford protocol
- Stability: capacity to remain viable and virulent
  - Ongoing germination tests to investigate “shelf life”
- Effects of passage
  - Attempt to increase virulence – only 35% in previous study

Field Trial Site

Achirensua – Ashante Region





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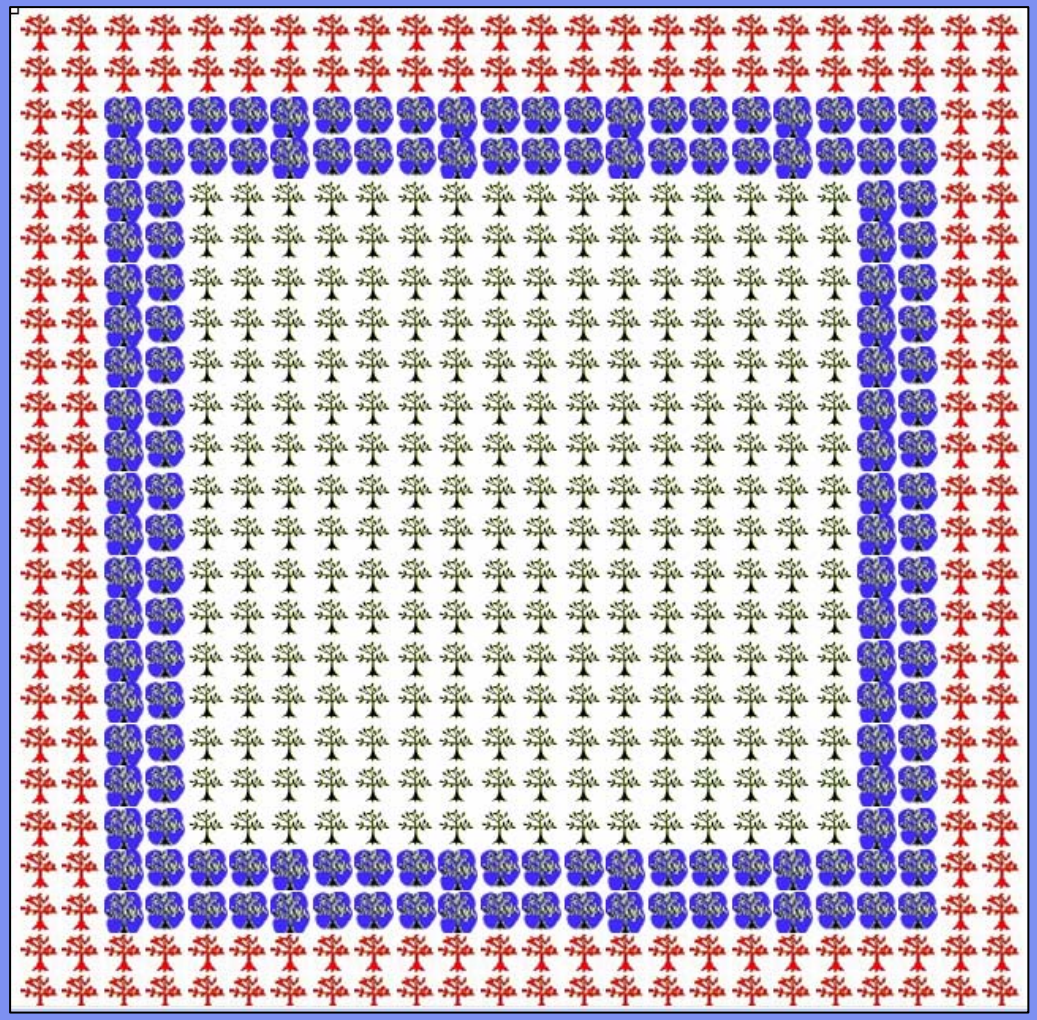
Field Trial Design – One Acre Plot



Unsprayed Buffer zone

Sprayed Guardian zone

Sprayed and randomly sampled

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Field Trial Design

- Factorial Experiment with Four Replicates
- Treatments
  - Two doses of the Biopesticide Standard (Currently I00-1183)
  - One dose of Chemical Standard (Currently Thiamethoxam)
  - One Control (spray water only)
- Formulation
  - Ondina:Shellsol T ULV
  - Alternative - locally produced

Application Assessment

- Motorised Mistblower Evaluation
- Sponsored by Mars
- Importance of Droplet Size and Vertical Throw
- Full understanding of the biology of the target species

Why the Application needs to be right!

- Cocoa Stand at Akwadum
- In excess of 12m
- Sprayers tested achieved spray deposition between 8 and 11m
- Thank you to Joe for providing scale!

In Summary

- Isolate Characteristics linked to Bioassay Results
- Existing Standard Isolate – *Beauvaria bassiana* I00-1183 to be screened for activity and then mass produced for initial field trials, along with Chemical Standard - Thiamethoxam
- Field trial site identified and experiment design in progress (1st field trial scheduled for September 07)
- Existing application practices assessed and suggestions to be presented to CRIG in a report
- Isolate Survey due to be initiated in Ghana when counterpart becomes available

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Any Questions?

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