Why Mycopesticides for Mirid Control?

(Component of: SAFE CONTROL OF MIRID PESTS ON COCOA IN WEST AFRICA)

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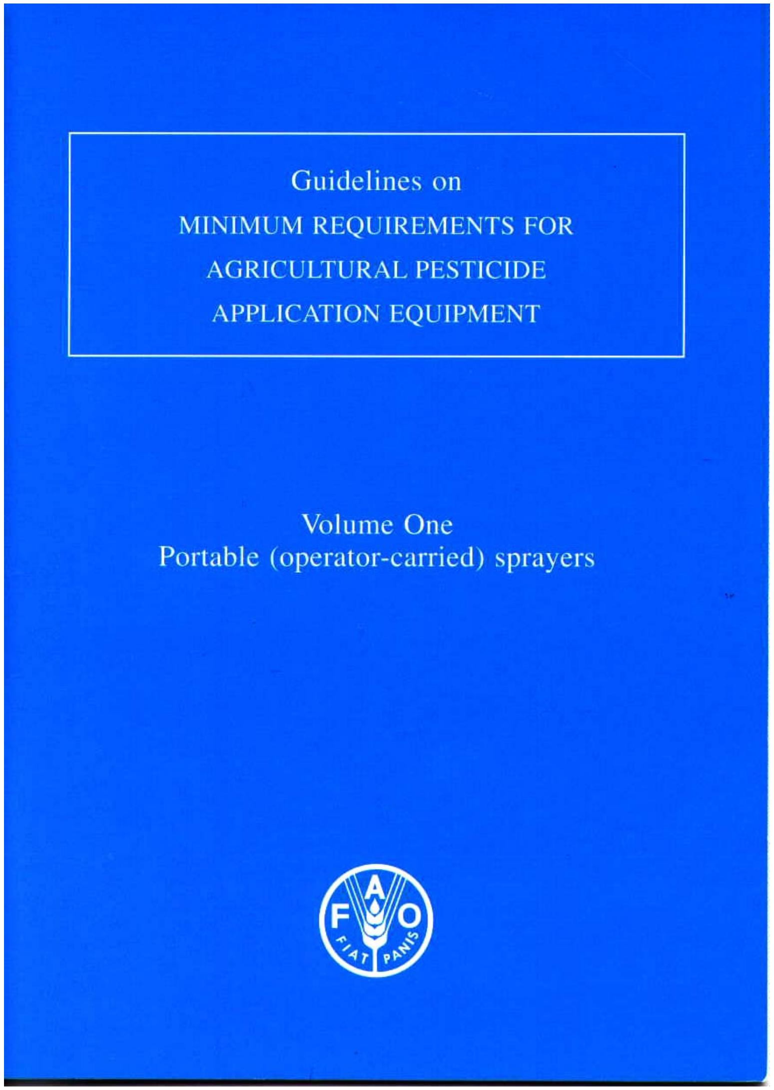
Early days…

Currently:

Evaluation, specifications, training

Serving the needs of farmers: especially small-holders



Cocoa: Key African Insect Problems

- **Mirids (capsids)**
- Cocoa shield bug: *Bathycoelia thalassina*
- Stemborers (*Eulophonotus* sp.)
- Diseases (*e.g.* CSSV, some black pod lesions) - transmission by insects

Capsids
Heteroptera: Miridae

Africa:

Sahlbergella singularis
Distantiella theobroma
Afropeltis (Helopeltis) spp.

Now mostly *Sahlbergella*

- Causes stress and yield decline
- May kill branches and trees
- Thrive in open canopy (as opposed to *Phytophthora* spp.)

Issues with mirid control

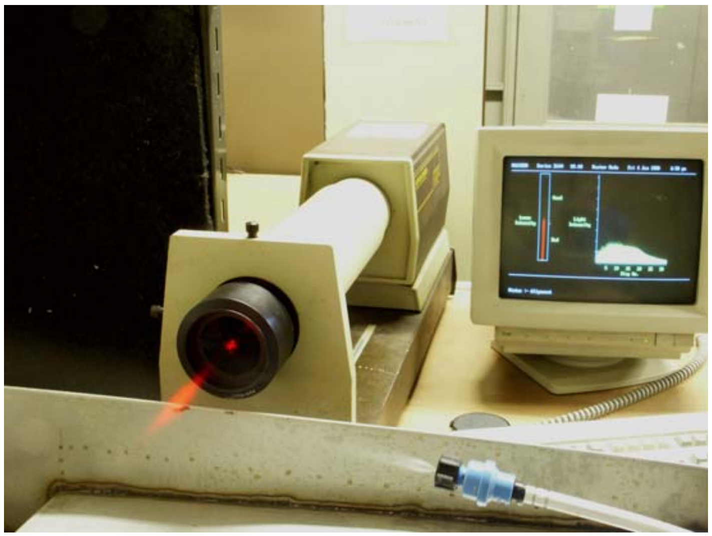
- All cocoa varieties are affected by mirids, but modern ones less so than Amelonado (possibly tolerance to infections of *Calonectria rigidiuscula* and other mirid transmitted fungi).
- Offset by change in environment: reduced shade encourages mirids
- Principal method of control is by insecticide sprays. Many current ones belong to WHO/EPA toxicity class II, (require precautions but most small-holder farmers have limited access to protective equipment).
- In the past, insecticides (*e.g*. lindane, endosulfan, propoxur) have been chosen with persistence and vapour action to counteract <u>poor application</u>. They have a broad spectrum of activity against arthropods: including pollinators and the natural enemies of pests.

Issues with mirid control (2)

- Insecticides are a focus of attention in regulations for residues on commodities in the EU and Japan. 2,000 t of Ghanaian cocoa recently rejected in Japan. Residue tolerances will be at the level of detection (and methods continue to improve).
- Newer products often more expensive than their predecessors.
- … together with regulation, this will probably further limit the <u>diversity</u> of insecticidal <u>modes of action</u> (MOA) used. Insecticide resistance was recorded during the 1960s.

Optimising pesticide application

- Maximise the **dose** onto the **biological target**



- Minimise:
  - operator contamination
  - waste (dosage of non-target areas)
  - impact on non-target organisms

Assessing hazard and raising awareness

Toxicity classes: EPA (WHO)

- class I - highly hazardous
- class II - moderately hazardous
- class III - slightly hazardous
- class IV - minimal hazard.

suitable for unprotected smallholders

Some insecticides that have been used against mirids (recently in Ghana)

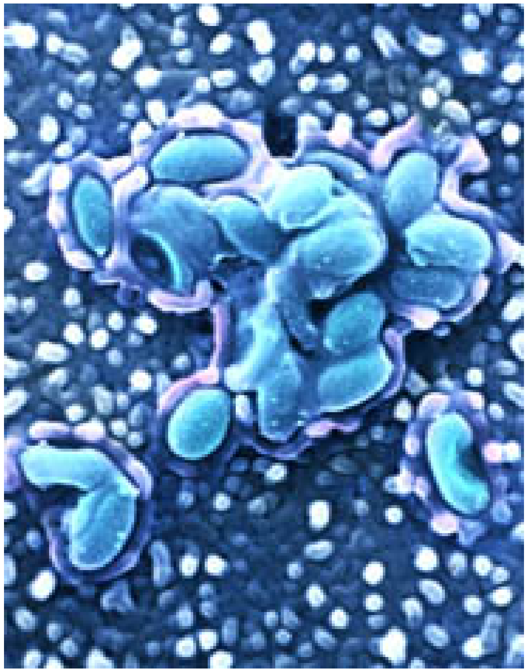
Chemical Class	Common name	Tox. Class (WHO)	EEC/91/414 Annex I
Organochlorine	endosulfan	I	No
	gamma-HCH	II	No
Organo - phosporus	pirimiphos methyl	II	Y
	chlorpyrifos (ethyl)	II	Y
Carbamate	promecarb (Carbamult)	I	No
	propoxur	II	No
Neonicotinoid	Imidacloprid (Confidor)	II	Y
	thiamethoxam	III	Y
Pyrethroid	bifenthrin	II	Y
	deltamethrin	II	Y
	fenvalerate	II	No

('Cocostar' = bifenthrin + pirimiphos methyl)

Reducing toxic insecticide use

- Action thresholds (available)
- Newer compounds (*e.g*. thiomethoxam)
- Pheromones?
- Biopesticides?

Mycoinsecticides



- Typically formulated conidia of entomopathogenic fungi
- Contact action
- Need for moisture can be overcome with formulation
- Often specific to family-order level
- Potential for long-term efficacy (horizontal transmission)
- Safety should not be assumed - but good track record with key genera
- No residue issues?

After 15 years of LUBILOSA …*

- A mycoinsecticide product ('Green Muscle')
- A number of "enabling technologies" for further product development

* LUtte BIologique contre les LOcustes et les SAuteriaux
sponsored by: CIDA, DfID, DGIS, SDC, USAID
implemented by: CABI, CILSS, GTZ, IITA, Imperial Coll.

www.lubilosa.org

Stages in mycoinsecticide development

- Identification of virulent fungal isolates
- Mass production systems:
  - pilot
  - commercial
- Spore separation and packaging
- Storage techniques and models
- Formulations (oil-based)
- Application methods
- Field testing techniques
- Registration, tox. testing and licensing

The 'MycoHarvester': an enabling technology

- Better formulation: (formulate spores, not the substrate!)
- Operator safety: spore dust is sucked into the machine.
- Ability to directly correlate weight of spore preparation with CFU concentration
- Aids drying & reduces packaging: crucial for storage.

Finding effective fungi

- Isolates found on cocoa in Ghana?
- *Beauveria, Metarhizium, Peacillomyces* spp
- Imported isolates only by prior agreement with Ghanaian phytosanitary authority

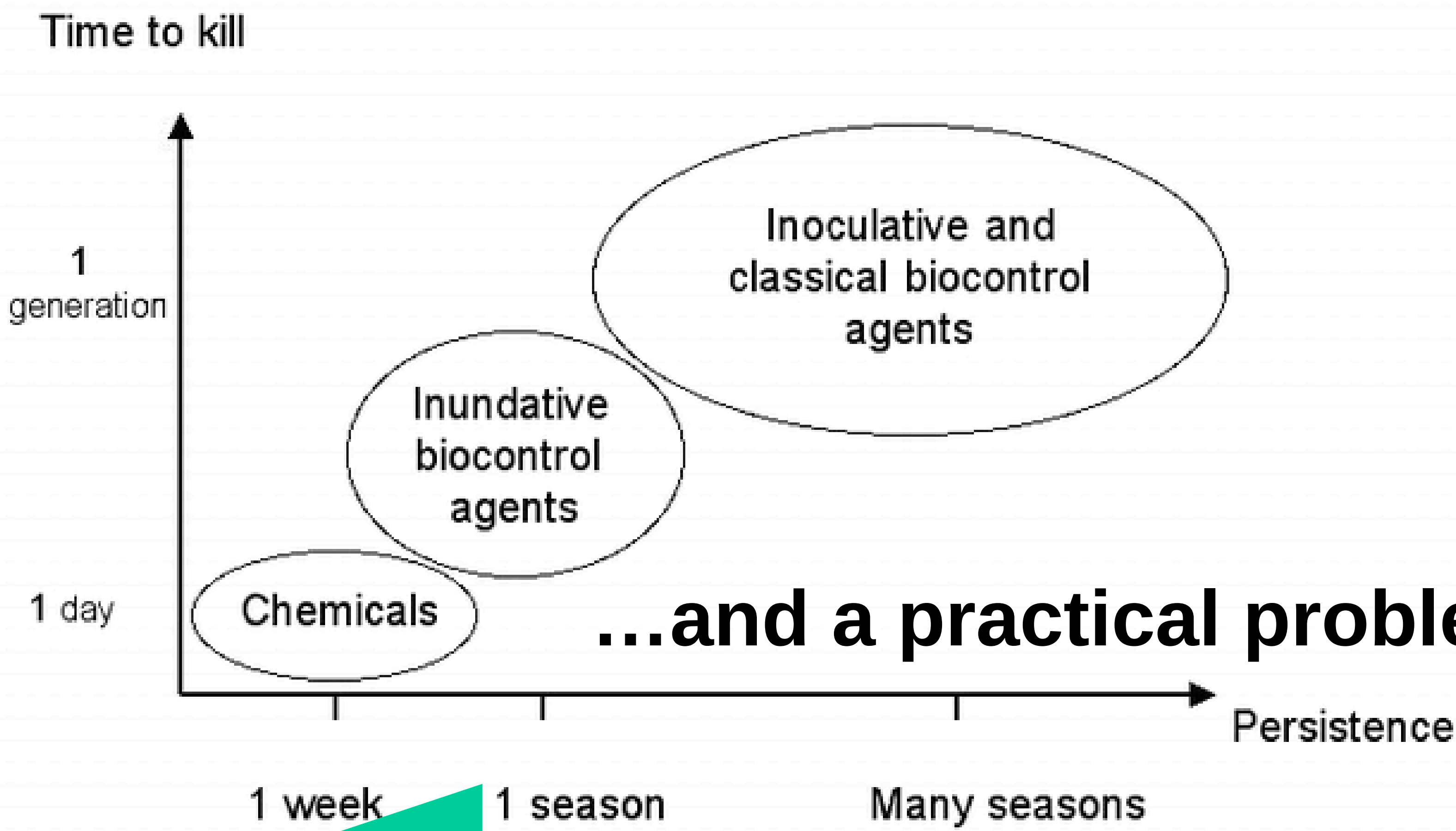
Preliminary work: developing assay techniques

Cotton stainers (*Dysdercus*) as surrogates, allows cross-border collaboration, including use of advanced facilities at IPARC

Killing insects in the lab is relatively easy…

- Application method: farmer practice!
- How to assess efficacy in the field?
- conidial persistence after application
- … but is the “(bio)pesticide model” the most apropripate?

A Theoretical Framework …



…and a practical problem

Ease of measurement (log scale!)

Lomer & Langewald (2001) *J. Orthoptera Res*. **10**: 335–341

An added benefit

The screening methods and laboratory-to-field procedures developed for assessing slow-acting mycoinsecticides will be applicable to assessment of new chemistries that have a low impact on non-target organisms and thus are compatible with Integrated Pest Management (IPM) practices

Conclusion - suggested priorities:

- Establish capacity to identify pathogens and evaluate biopesticides and options for field trials for slow-acting control agents. This means always working closely with local counterparts
- Make collection of microbial control isolates. Agree policy on exotic isolates if necessary
- Optimise and use cocoa mirid bioassay technique and prove use of surrogates (*e.g. Dysdercus*)
- Formulate promising isolates and evaluate in laboratory and then field
- Quantify application parameters (spore delivery and preliminary economics) of promising isolates
- Lab to field ASAP