The Mirid Pheromone: Perspectives and Prospectives

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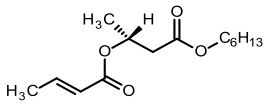
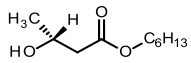
Presentation outline

- Parameters for trapping
  - Synthetic pheromone blend
  - Traps
- Mass trapping
- Potential for monitoring
- Prospects for mirid management

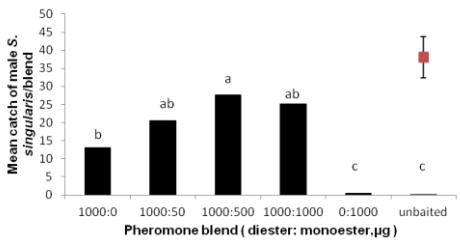
Synthetic Pheromone blend



(I)

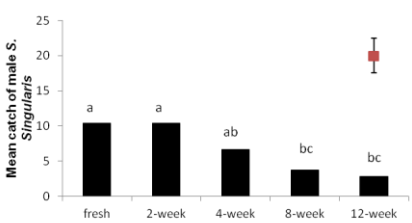


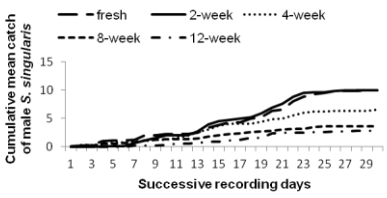
(II)



- No single lure had the greatest catch
- 1000:500 greater than diester alone; selected.

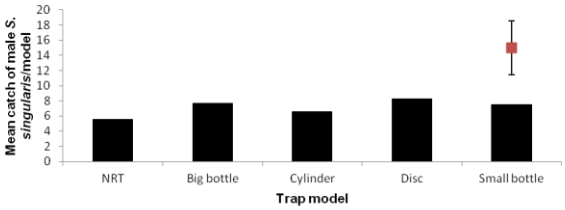
Lure ageing





- Optimal attraction at 0-4 weeks but could be at least 6 weeks
- Attractive for more than 12 weeks

Trap Models



- Water traps suitable for mass trapping and lure and kill.
- Sticky traps suitable for scientific monitoring

Mass trapping as a method of control against mirids

1. Research plantation at Acherensua

2b	2d	4a	4a	6e	6d	8a	8a
c	b	e	b	a	b	e	c
a	c	b	d	b	a	d	e
d	a	c	e	d	e	c	b
e	e	d	c	c	c	b	d
d	a	a	e	d	d	e	c
a	c	c	b	a	e	c	a
b	d	e	c	e	c	b	e
e	e	d	d	b	b	a	d
1c	1b	3b	3a	5c	5a	7d	7b

a=0
b=2
c=4
e=15
d=8

Randomised blocks split- plots design with 0.5 ha Whole Plots.

Treatment
Control
Monitoring traps

Methodology

- Trapping in treatment plots (15 traps per subplot, Jan 2008- July 2009)
- Monitoring by different densities of traps after 3 months
- Insecticide knockdown after 7/8 months
- continued monitoring by solitary traps
- Monthly visual assessment of mirid numbers and damage

Mass trapping as a method of control against mirids

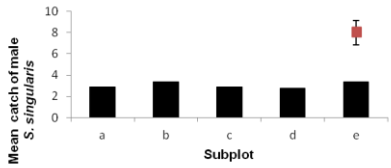
2. Smallholder organic cocoa farms at Mfranor and Atiebu (WCF Programme, 2009&2010)

Methodology

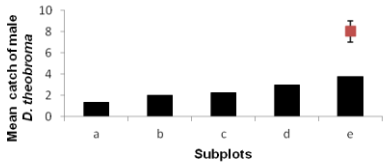
- 6 treament farms trapped whole
- 6 control farms monitored at 1trap/ha
- Monthly visual assessment of mirid numbers and damage

Results (Acherensua)

Mean trap catches before monitoring



Mean trap catches of male *S. singularis*.

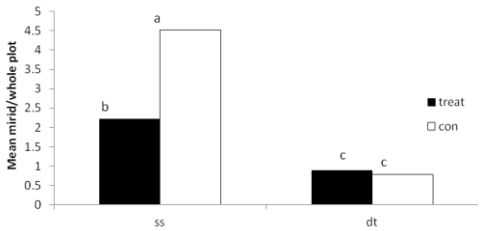


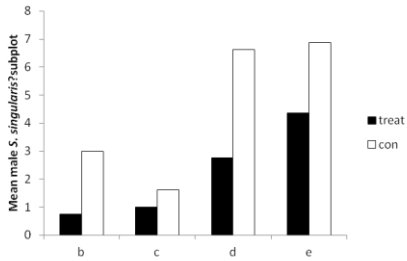
Mean trap catches of male *D. theobroma* in mass trapping plots

- Results of treatments can be compared among the plots

Results cont'd

Multiple density monitoring traps

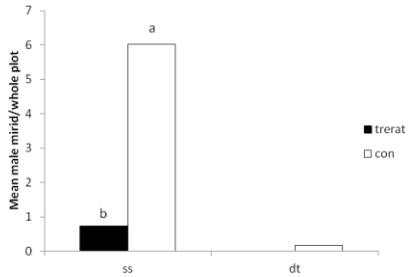




- mass trapping reduced male *S. singularis* numbers but not *D. theobroma.*

Results cont'd

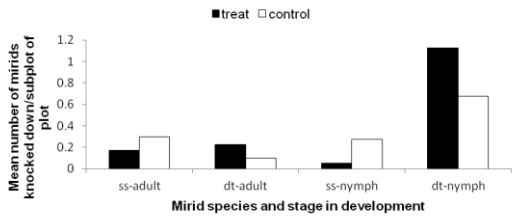
Single trap monitoring



- Trapping was effective in decreasing numbers of male *S. singularis.*

Results cont'd

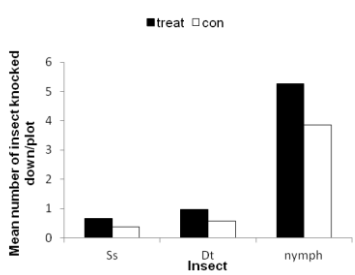
Knockdown



- Field populations of mirids not reduced

Results cont'd

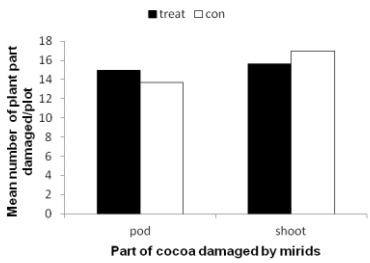
Visual assessment of mirid numbers



- Trapping did not reduce the field populations of mirids.

Results cont'd

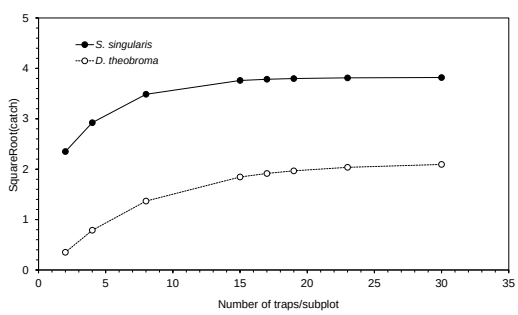
Visual assessment of mirid damage



Untransformed mean pod and and shoot counts from treatment and control plots(75 trees / plot)

- Mirid damage was not reduced by pheromone trapping.

Results con'd



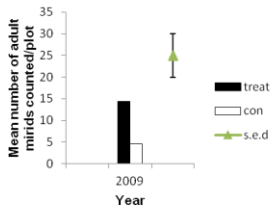
- 0ptimal trap density

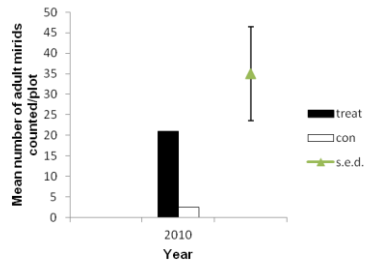
  - *S. singularis* is 150 traps/ha

  - *D. theobroma* is 230 traps /ha

Results (WCF)

Visual assessment of mirid numbers(WCF)

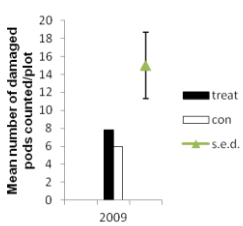


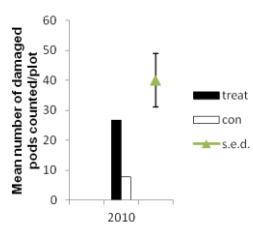


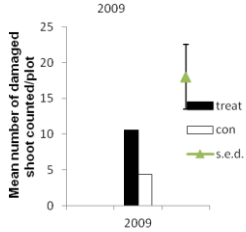
- Mass trapping did not reduce mirid numbers in the field.

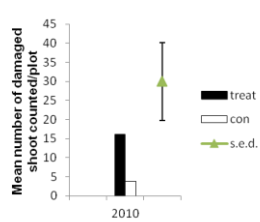
Results cont'd

Visual assessment of mirid damage









- Mass trapping did not reduce mirid damage

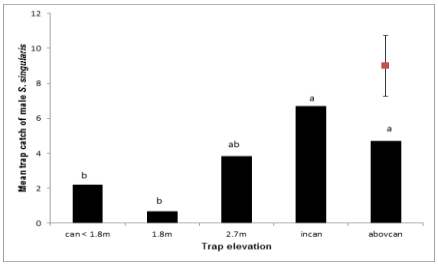
Mean shoot and pod damage by *Sahlbergella singularis* and *Distantiella theobroma* in pheromone treated and untreated farmers' organic cocoa farms at Mfranor and Ateibu in 2009 and 2010.

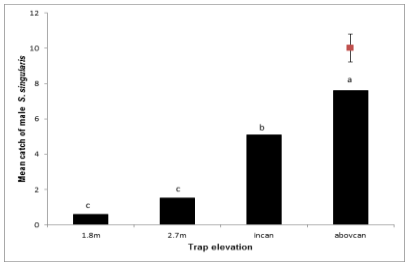
Reasons for ineffectiveness of mass trapping??

- Immigration
- High density of mirids
- Trap density (Sarfo et al., 2007)
  - -*S. singularis* ……adequate(150/ha)
  - -*D.theobroma*….230 needed; about 35% less
- Non – optimal trapping height (Sarfo et al., 2007)
- Lure??

Trapping height expts

- Traps at various heights on different cocoa trees at Akwadum
- Traps at various heights on single pole at Suhyen





- catches of male mirids showed close association with the cocoa canopy rather than absolute height
- little vertical displacement during flight

Mass trapping at Afosu and Bunso

Treatment- isolated by trapping

Control-no isolation

Chemical- isolation and insecticide application.

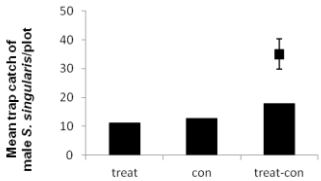
Core for data collection

DESIGN- Randomised complete block design (RCBD)
3 treatments, 5 replicates; 4 at Afosu 1 at Bunso

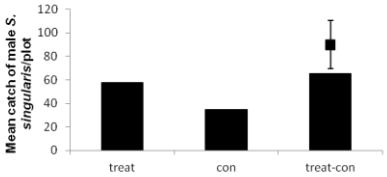
Methodology

- monitoring of demarcated plots before mass trapping expt
- Trapping of whole plot (about 1.2 ha) except control where only core is trapped(230 water traps/ha, 1000:500 lure, trap in canopy or nearest point)
- Application of imidacloprid at 150ml/ha in chemical plot, end September
- Monthly insecticide knockdown (imidacloprid) from September
- Monitoring of mirid numbers in core area with two traps, start October.
- Monthly visual assessment start October
- Data collected from core area only
- Data analysis

Results

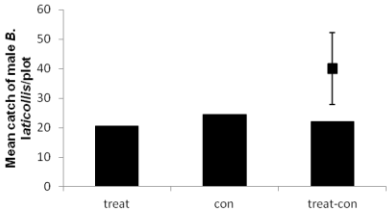


Mean trap catches of male *S. singularis* prior to mass trapping.



Mean trap catches of male *S. singularis* in mass trapping traps

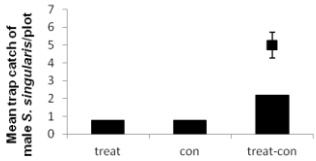
- Mirids present in all plots equally before mass trapping
- *Bryocoropsis laticollis* also attracted by synthetic lure



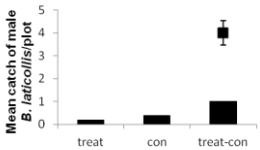
Mean trap catches of male *Bryocoropsis laticollis* in mass trapping traps

Results cont'd

- **Monitoring trap catches of mirids**



Mean trap catches of male *S. singularis* in monitorng traps

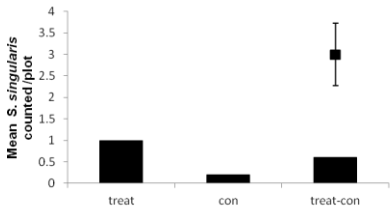


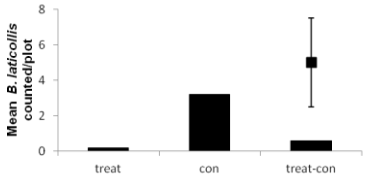
Mean trap catches of male *B. laticollis* in monitorng traps

- Pheromone trapping of isolated plots and also in combination with one imidacloprid application did not reduce the male mirid numbers.

Results con'd

- **Visual assessment of mirid numbers**

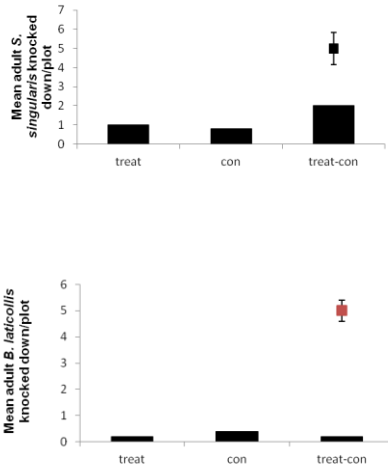




- Pheromone trapping of isolated plots and also in combination with one imidacloprid application did not reduce male mirid numbers.

Results cont'd

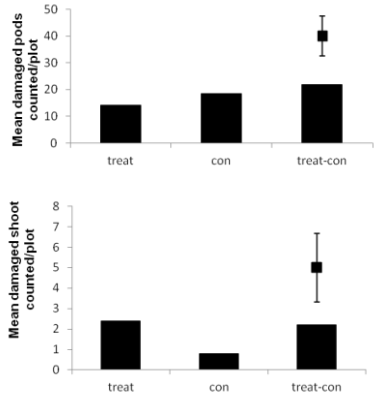
Insecticide knockdown of mirids



- Field populations of mirids not controlled

Results cont'd

- **Visual assessment of mirid damage**



- Pheromone trapping of isolated plots and also in combination with one imidacloprid application, did not result in decreased mirid damage to pods and shoot.

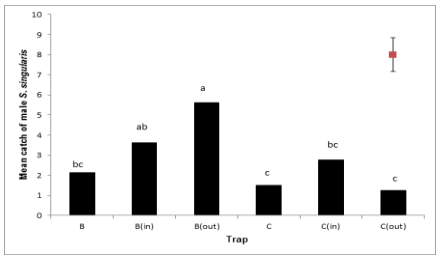
Mirid attraction and capture by pheromone trap

- **Field bioassay (at Afosu)**
- 2 water traps; one 'normal', one with sticky outside
- 2 sticky traps; one 'normal' one with sticky outside
- RCBD; 8 replicates in 'mirid pockets'
- 1000:500 lure
- analysis

Traps used

Results

- 135 *S. singularis*, 36 *B. laticollis* and one *D. theobroma*



Mean catches of male *S. singularis* inside and outside of traps

- catches on the outside of the bottle trap significantly higher than all pt the inside catches of the same trap with the glue outside
- inside of the normal bottle caught only about 38% of the outside catch and 23% of the total catch (inside and outside) by the bottle with glue.
- not all mirids attracted to the normal trap were caught (also observed in the field)
- catches can be optimised with the inclusion of outer surface for trapping.
- helps to explain the ineffectiveness of mass trapping to control mirid numbers and damage

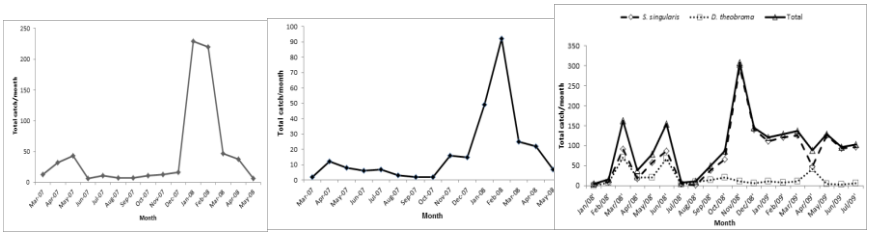
Reasons for the ineffectiveness of mass trapping

- All mirids attracted to traps do not enter it directly
- Trap model does not capture all mirids attracted to it
- Significant numbers of mirids flying outside the level of the trap escape capture

Prospect for monitoring

- Population dynamics of mirids

-on the average low numbers are recorded from February to July and high numbers from August to January. (Gibbs *et al.*, 1968; Owusu- Manu and Somuah, 1989)



S. singularis; Trap models- Akwadum Lure blends – Akwadum Mass trapping- Acherensua

- Catches at both high and low densities
- Trap catches appear to mimic population dynamics
- Pheromone traps detect presence of mirids
- may monitor seasonal incidence
- But can pheromone trap catches be used for the development of threshold for mirid numbers and/ damage??

Prospect for monitoring: Threshold development

Correlataion and regression of mass trapping and monitoring trap catches of mirids and mirid numbers and damage at Acherensua.

Results (correlation**)**

Trap catch parameter	Visually assessed parameter	Co-efficient of correlation (r)	Probability	Statistical significance
S. singularis	Nymphs	0.381	0.02	s
	Pod damage	0.483	0.002	s
	Shoot damage	0.400	0.01	s
	Total damage	0.557	0.002	s
Mirids	Nymphs	0.399	0.01	s
	Pod damage	0.472	0.002	s
	Shoot damage	0.399	0.01	s
	Total damage	0.546	0.003	s

Prospect for monitoring: Threshold development cont'd

Regression

- General linear relationships (mass trapping trap catches; 150/ha)
  - -male *S. singularis* and nymphs
  - -male mirids and nymphs
  - - predictive
- Parallel regression relationships (monitoring trap catches; 10/ha)(predictive)
  - -male *S. singularis* and shoot damage
  - -combined mirid species and shoot damage
  - -predictive
- Separate regression relationship (monitoring trap catches)
  - - male *D. theobroma* and mirid populations. (non predictive)
- Optimal trap density for monitoring needed
-

Conclusion

Present quantitative relationship between trap catches and mirid populations and damage can be developed to estimate future damaging mirid populations and damage for the development of threshold levels.

Prospect for direct control: Lure and kill

Maximisation of trap captures

- Coating of trap surface with contact insecticide
- Placement of traps at different heights(canopy, 2.7m and /or 1.8m)

Conclusions

- Synthetic pheromone blend and traps have been developed for pheromone trapping. Utilization of these parameters in mass trapping did not control mirid numbers and damage though numbers of male *S. singularis* were significantly reduced. However, captures by pheromone traps can be maximised.
- Presently pheromone traps monitor incidence and seasonal occurrence of mirids and there is evidence from the study that it can be developed to determine threshold levels for mirid numbers and damage.

Mirid species and damage

- species

- Damage

Acknowledgements

- CRUK
- CRIG
- NRI

THANK YOU