

# Insect rearing and African sugarcane Area-Wide Integrated Pest Management: Achievements and challenges

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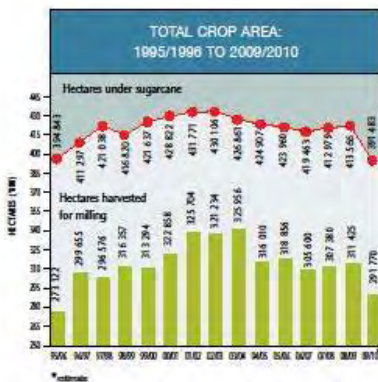


## The South African Sugar Industry



## Area under sugarcane

CROP DATA



Season	Yields				Yields per hectare of harvested cane	Rainfall June to May (mm)
	Sucrose % Cane	Tons cane to 1 ton sugar	Tons cane crushed	Tons sugar made		
1996/1997	12,60	9,23	20 950 894	2 269 195	69,92	976
1997/1998	12,63	9,18	22 154 775	2 412 914	74,70	1101
1998/1999	13,36	8,67	22 930 324	2 646 172	72,48	801
1999/2000	13,77	8,38	21 223 098	2 531 805	67,74	1306
2000/2001	13,08	8,77	23 876 162	2 729 219	73,95	894
2001/2002	13,11	8,83	21 156 537	2 395 566	64,96	1001
2002/2003	13,71	8,33	23 012 554	2 762 885	71,64	850
2003/2004	13,70	8,44	20 418 933	2 419 287	62,64	792
2004/2005	13,52	8,54	19 094 760	2 234 898	60,42	898
2005/2006	13,74	8,40	21 052 266	2 507 203	66,02	921
2006/2007	12,92	9,07	20 278 603	2 235 287	66,36	982
2007/2008	13,47	8,64	19 723 916	2 281 765	64,17	1026
2008/2009	13,69	8,49	19 255 404	2 269 087	68,70	941
2009/2010	13,68	8,53	18 655 089	2 187 542	67,67	973

## More facts and figures

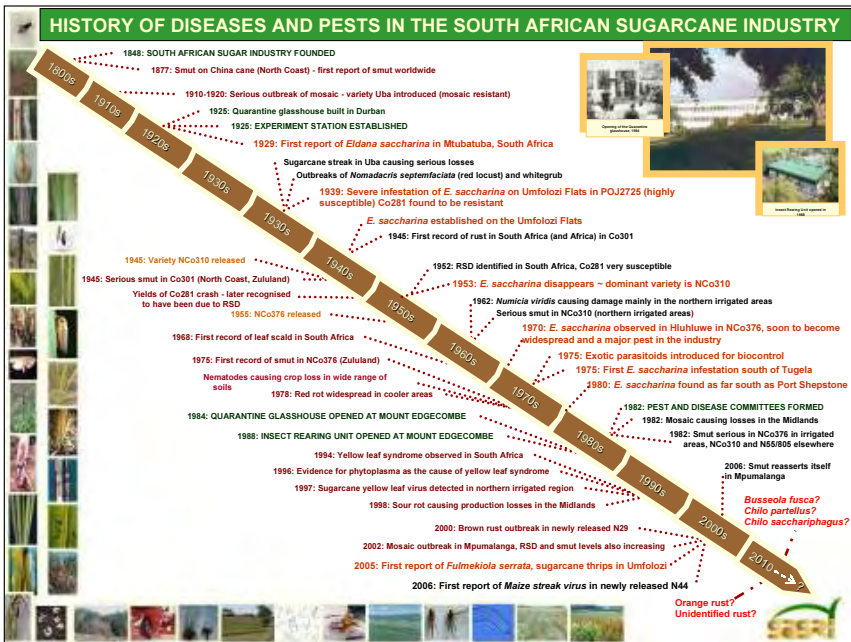
- Cane growing comprises 35300 registered growers (33700 Small scale; 1570 commercial)
- In addition to the farmers, it directly employs a further 77000 people, and indirectly another 350000 (In total 2% of SA's population)
- Sugar manufactured by 6 milling companies utilising 14 mills, with 60% marketed in SA Customs union
- The industry promotes sound and sustainable environmental practices within its area of influence conforming to national and international norms

# Geography



# The Beginning

- S A sugar industry, since its start has only been significantly affected by two insects, both indigenous.
- *Numicia viridis* (Hom.: Tropicuchidae) brought under control by two indigenous egg parasitoids.
- *Eldana saccharina* (Lep.:Pyralidae), since 1970 has spread throughout most of the industry. Is currently the main focus of the entomology programme.



# Eldana saccharina

most in SA  
"ed"  
throughout

effective against it under

- Generally though, an effective programme against it has
- Knowledge based AW-IP sugarcane a grass in a ecological system- not t

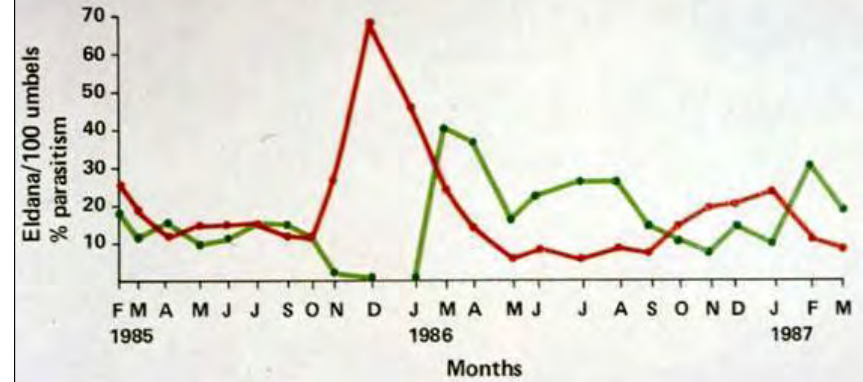
# Ecosystem services

Many predators impact on eggs and small larvae in sugarcane



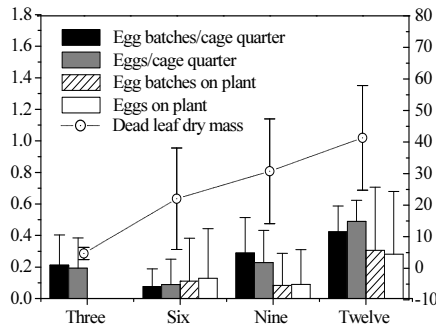
In Eldana's indigenous habitat, parasitoids keep it in balance

## THE TOTAL PARASITISM OF ELDANA IN PAPYRUS UMBELS



## Eldana moth "likes": Oviposition choice- indig. host

A: *Cyperus dives*

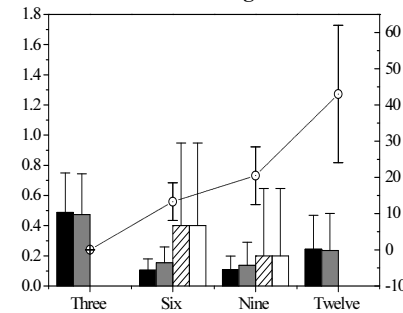


- Most eggs on cage netting and floor!
- Most eggs associated with 12 month old plants
- Least eggs with 3 month old plants
- Correlation with increasing dry biomass and egg numbers



## Eldana moth "likes": Oviposition choice- cane

D: N30 sugarcane

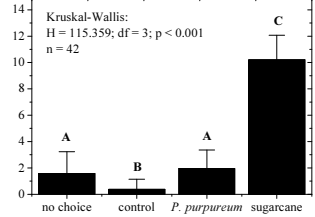


- All eggs on cage netting and floor in youngest and oldest plant quarters
- Eggs laid on 6 and 9 month old plant material
- No correlation with increasing dry biomass and egg numbers

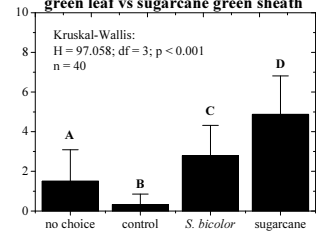


# Eldana larval "likes": Plant species

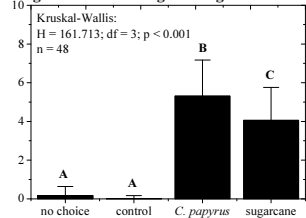
**A: Larval choice: *Pennisetum purpureum* green sheath vs. sugarcane green sheath**



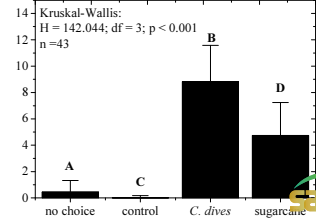
**B: Larval choice: *Sorghum bicolor* green leaf vs. sugarcane green sheath**



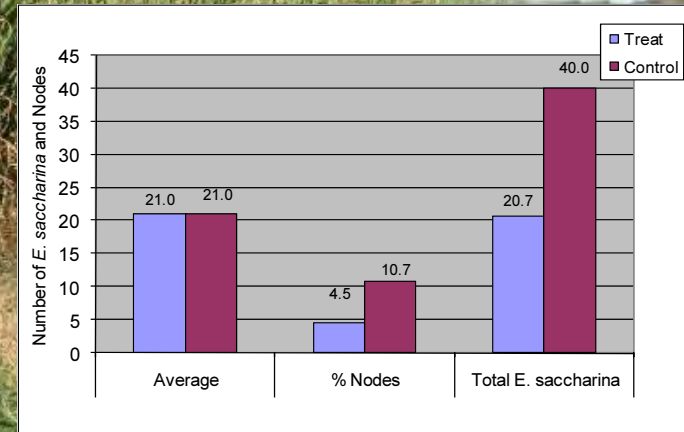
**C: Larval choice: *Cyperus papyrus* top green bracts vs. sugarcane green sheath**



**D: Larval choice: *Cyperus dives* green leaf vs. sugarcane green sheath**

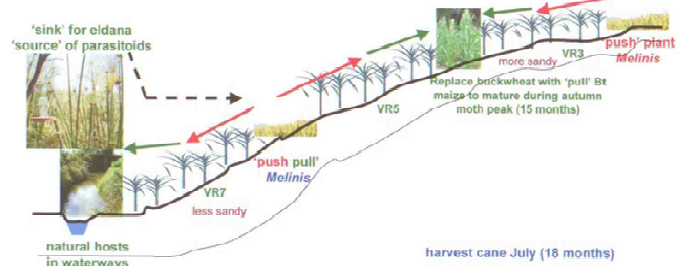


# Eldana moth "dislikes": Habitat Management



Predator/parasitoid movement

Eldana push & pull



Is there a need for sugarcane ecological networks the ecosystem services they provide?

# Ecosystem services



## Water resources



## Impact of invasive alien plants (IAP's)

- 7% (3300 million m<sup>3</sup>) of SA mean annual water runoff lost through transpiration of IAP's in catchments, riparian zones and wetlands
- Biocontrol identified as only sustainable mechanism of control
- In 1996 biocontrol already reduced financial commitment of funders by 19.8% (154 000 Euros)
- Estimated that it can still reduce financial commitment by 41% (320 000 Euros)



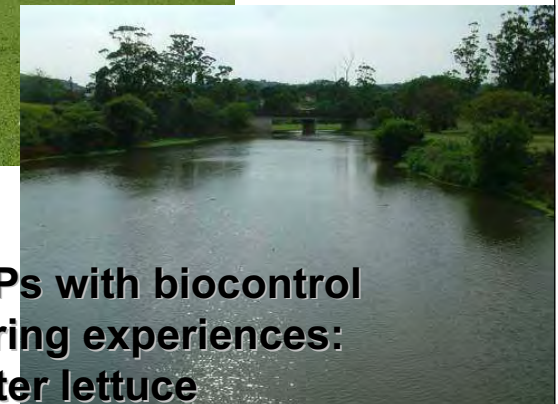
## AW-IPM and insect rearing?

- Clearing IAP's with biocontrol agents- especially those mass reared?
- Increased habitat for indigenous host plants?
- Increased habitat for crop pests and their natural enemies?
- Habitat management can be accomplished more readily and populations of natural enemies augmented?
- Because of large area of sugarcane relative to indigenous habitats, is habitat management all that is needed in AW-IPM?

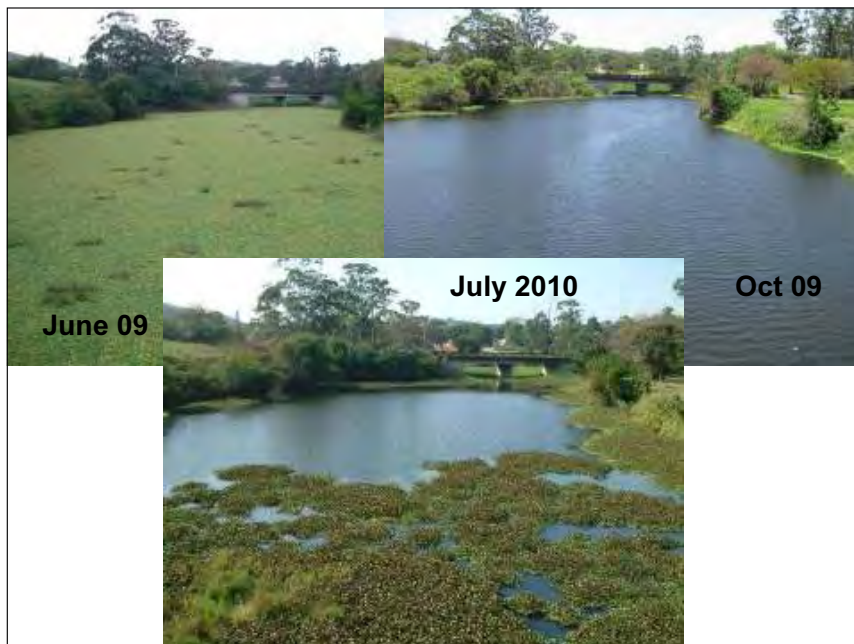
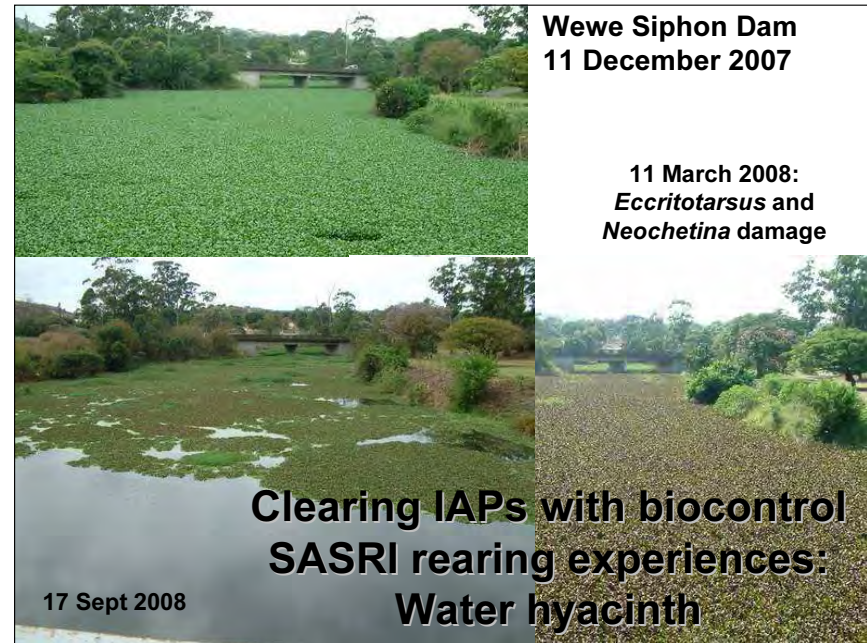
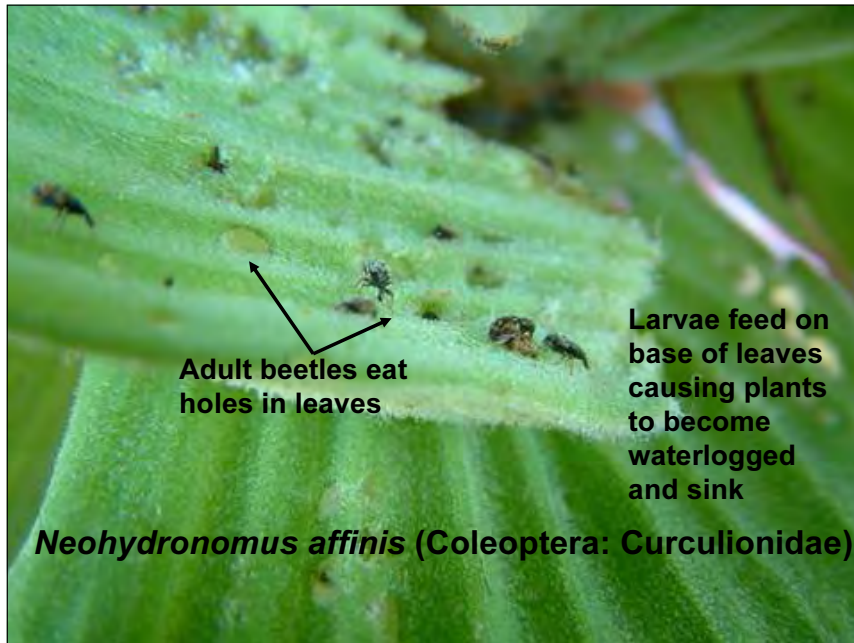


22 October 2007:  
After release of 8700  
*Neohydronomus affinis*

Wewe Siphon Dam  
11 September 2007



**Clearing IAPs with biocontrol**  
**SASRI rearing experiences:**  
**Water lettuce**



in restricting the spread of water hyacinth mats, it has a broad climatic tolerance, but has a patchy distribution because of its need for young, soft water.

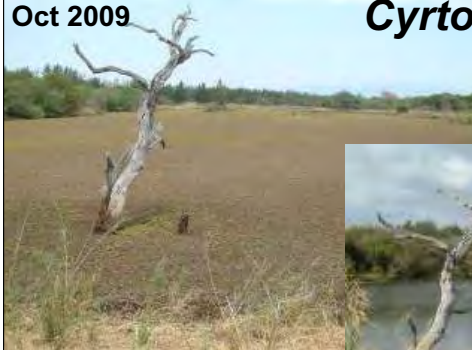
### ***Eccritotarsus* (Homoptera: Miridae)**




*Eccritotarsus catarinensis* (Miridae) is a sap-sucking insect. Adult mirids (C) are slender, about 3 mm long, black with pale legs and reddish eyes. The adult female inserts eggs into the leaf tissue mainly on the undersurface of the leaves. Nymphs and adults feed on the undersurfaces of leaves. Feeding causes yellowing of leaves due to extraction of chlorophyll, and this reduces the vigour of the plants. The leaves eventually dry out (D). The mirids prefer mature stands of water hyacinth where the canopy of leaves protects them from excessive heat and cold. Where it has become established, it has been found to be effective in restricting the spread of water hyacinth mats.

### **Clearing IAPs with biocontrol *Salvinia* (Kariba weed) and *Cyrtobagous***

Oct 2009



Aug 2010



Number released=9750 adults




### ***Cyrtobagous* sp. (Coleoptera: Curculionidae)**

Oct 08

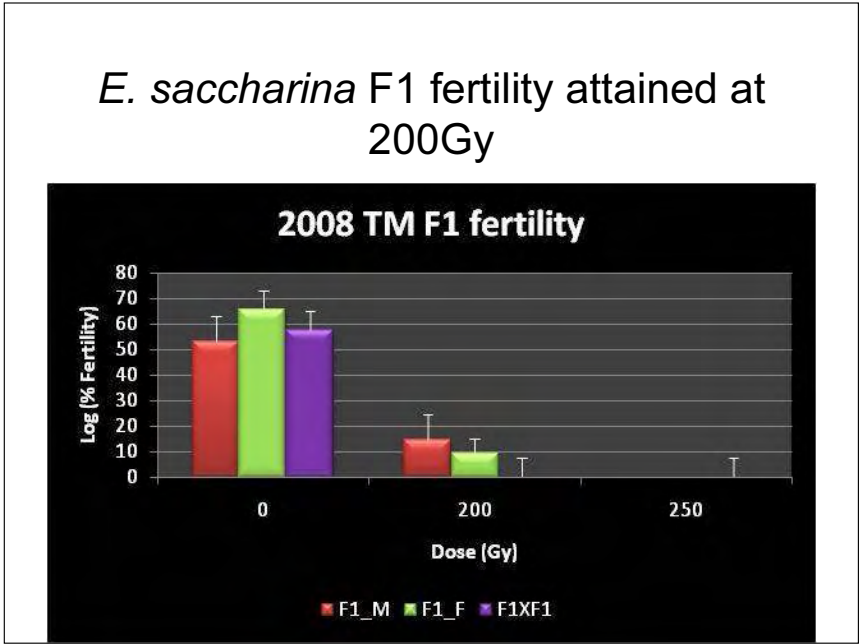
12800 *Neochetina* and 14400 *Eccritotarsus* released

Oct 09

June 2010



Increased habitat for indigenous host plants



### Effective insect mass rearing in integral to SIT

- In 1986 a custom designed Insect unit for *E. saccharina* was commissioned and built





## IAP agent release numbers: 01 May 2009 - 31 July 2010

Invasive species	Biocontrol agent	No. released
<b>- Terrestrial</b>		
Chromolaena	<i>Calycomyza</i>	19,280
Lantana	<i>Longitarsus</i>	979
	<i>Coelocephalopion</i>	583
Pereskia	<i>Phenrica</i>	12,408
<b>- Aquatic</b>		
Water lettuce	<i>Neohydronomus</i>	118,168
Water hyacinth	<i>Neochetina</i>	30,245
Kariba weed	<i>Cyrtobagus</i>	39,849
<b>TOTAL</b>		<b>221,512</b>

## Future of arthropod rearing and QC in African sugarcane AW-IPM

- Extremely healthy
- Funding for mass rearing 14 insect and 1 mite species as classical biocontrol agents for 7 IAP's over next 4 years
- Capacity for research into artificial diets for these
- SIT (F1 male sterility) distinct possibility as part of AW-IPM for *E. saccharina*
- SIT considered as biosecurity option to prevent invasion in SA of the exotic stalk borer *Chilo sacchariphagus*
- Both *E. saccharina* and *C. sacchariphagus* have natural enemies that can be mass reared for augmentation in AW-IPM programmes
  - **INSECT REARING IN SA THUS HAS WONDERFUL CHALLENGES FOR THE FUTURE**

## Acknowledgements

- SASRI for supporting and funding the AW-IPM initiatives against sugarcane insect pests
- Working for Water Programme for funding the IAP biocontrol mass rearing initiative
- IAEA for funding rearing and radiation biology studies for *Chilo sacchariphagus*
- Tongaat-Hulett sugar company for funding the Wewe Dam IAP project
- Mozambique sugar companies for allowing and funding background ecological work on *C. sacchariphagus* invading their estates
- Insect mass rearing teams involved in sugarcane pest and their natural enemy and IAP agent rearing activities