

# Pest management by modifying insect development and behaviour



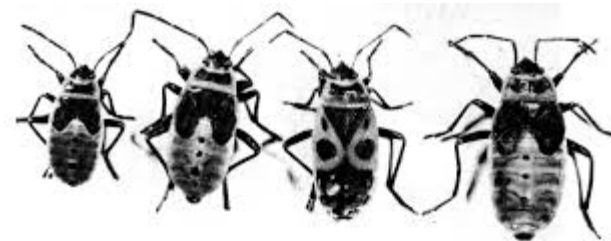
# Insect growth regulators(IGR's)

- Synthetic compounds possessing the activities of juvenile and moulting hormone of insects are called as IGR's/ JH mimics/ JH analogues/ Juvenoids.
- Retard the development of pest species particularly inducing effects from sterility to death.
- Effective only on immature insects.



# Invention of paper factor

- Discovered by Slama and Williams, 1967
- In *Pyrrhocoris apterus*
- Paper towel was developed from Balsam fir tree
- Mimic the JH- kills the insects without reaching to adult stage



# **Affects the insects in different ways**

- 1. Antimetamorphic effect**
- 2. Larvicidal effect**
- 3. Ovicidal effect**
- 4. Diapause disrupting effect**
- 5. Embryogenesis inhibiting effect**

# Chitin synthesis inhibitors

- ✚ Chemicals which interfere with the biosynthesis and deposition of chitin.
- ✚ Acts on chitin synthase.
- ✚ Acts as stomach poisons and kills insects at the time of moulting and also suppresses the fecundity and exhibits ovicidal and contact activity.
- ✚ Causes improper attachment of the new cuticle during moulting and produces a cuticle that lacks some of the layers.
- ✚ Larvae die from rupture of the new malformed cuticle, starvation, desiccation and predation.
- ✚ Benzyl phenyl urea analogues - affects the larval stage.

# **Practical IGR's found in market**

- 1. Methoprene (Altosid)- Homopterans and Dipterans**
- 2. Kinoprene (Enstar-IGR)- mosquitoes, flies**
- 3. Hydroprene (Altozar)- Lepidopterans, coleopterans, Homopterans and for few stored pests**
- 4. Pyriproxifen (Admiral)- flies, beetles, midges and mosquitoes.**
- 5. Diflubenzuron (Dimilin)- flies, midges and mosquitoes.**

# Other chitin synthesis inhibitors

- **Diflubenzuron (Dimilin)** - used in cotton, soybean, citrus, vegetables and also medical pests (mosquitoes).
- **Lufenuron (Match)** - lepidoptera and coleoptera on cotton, corn and vegetables.
- **Buprofezin (Applaud)** - produces weakened exoskeleton in moulting immatures both insecticides and acaricides. Used against hemipterans in rice.
- **Novaluron (Rimon)** - used for whiteflies on tomato and lepidopterans.

dimilin®  
SC-48

Match®



# Anti-juvenile hormones

- Tested plant extracts for antagonistic activity of JH.
- Discovered anti JH activity from bedding plant, *Ageratum houstonianum*.
- Identified 2 compounds- Precocene I and Precocene-II.
- As they induce precocious form of metamorphosis and their chemical structure.
- Induce premature metamorphosis.
- Lethal activation within the corpora allata, thus destroying the glands.
- Azadirachtin- liquid and dust formulations from neem seeds- disrupts molting process.



# Advantages

- **Effective in minute quantities and hence are economical**
- **Highly species specific; so non-target organisms are spared**
- **Affects more than one aspect of insect development and hence effective against insects which are resistant to insecticides.**
- **Highly biodegradable- non polluting, eco-friendly.**
- **Non-toxic to plants and animals.**
- **Suitable for insects which are living in concealed environments.**

# Disadvantages

- ✦ They have a narrow physiological windows; hence cannot be applied at all times.
- ✦ Effective only for last larval instars and hence stages will continue to feed.
- ✦ Slow mode of action
- ✦ Chances of resistance development
- ✦ Few are unstable in environment
- ✦ High cost of chemicals

# Push-Pull Strategy or Stimulo-deterrent diversion

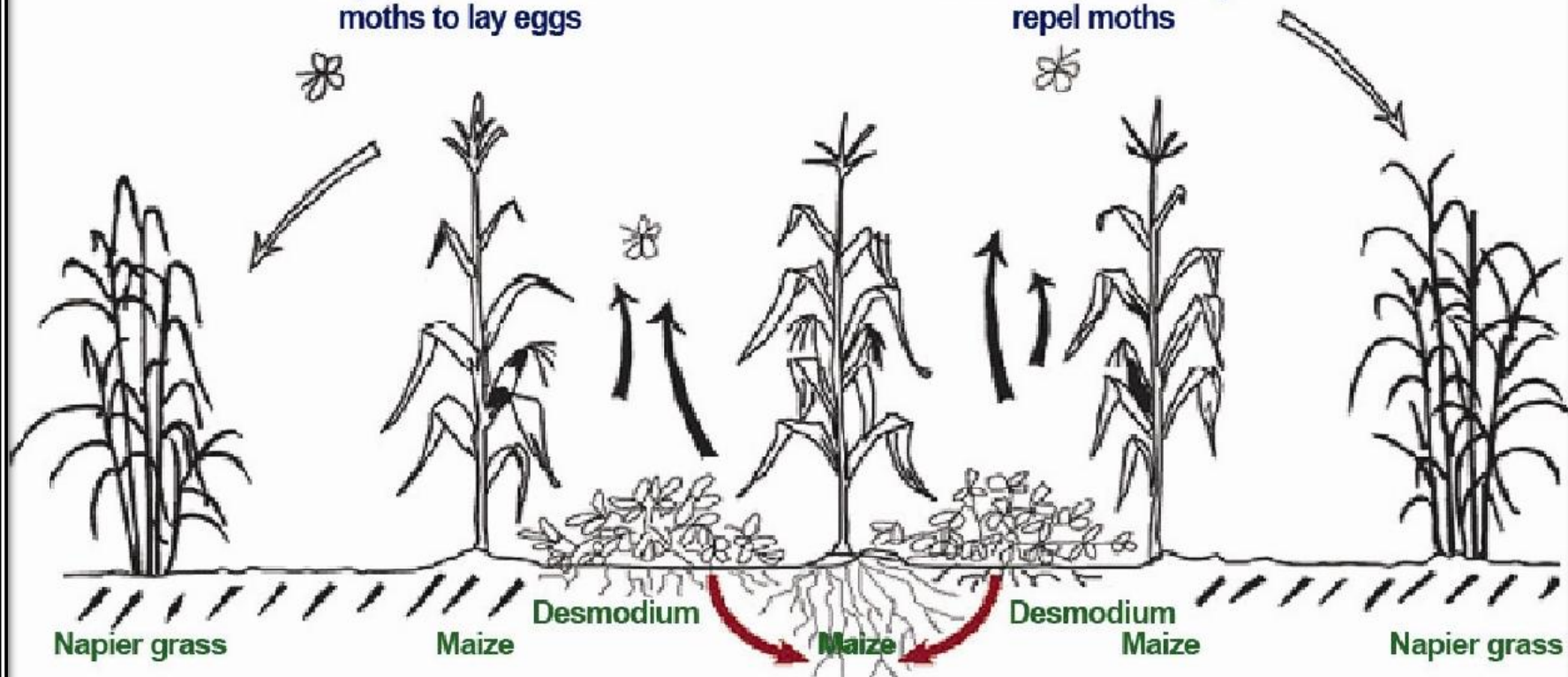
- ✦ A strategy where a host-plant attractant(s) and a repellent(s) are used in combination.
- ✦ Tested using a repellent intercrop and an attractant “trap” plant.
- ✦ Insects are repelled by volatiles emitted from the intercrop (push) and simultaneously attracted by volatiles from the trap plant (pull).
- ✦ The most successful work on push-pull to date has been conducted in Africa to control stem borers in maize and sorghum (Cook *et al.*, 2007).
- ✦ Works not only by decreasing stem borer damage to maize, but also by enhancing the efficacy of natural enemies.

# 'Pull'

Volatile chemicals from Napier border attract moths to lay eggs

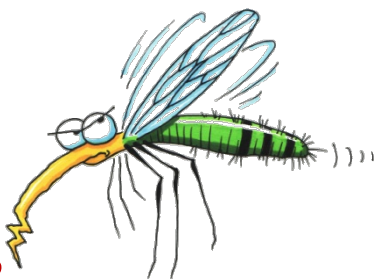
# 'Push'

Volatile chemicals from Desmodium intercrop repel moths



# Attractants

- Chemicals which elicit oriented movements by insects towards their source.
- Also called as Food lures



Important food lures includes

Sl. No.	Lure	Insect
1	Sugar + Molasses	House fly
2	Geraniol	Japanese beetle
3	Trimed lure	Mediterranean fruit fly
4	Melon fruit fly	Cue lure
5	Methyl eugenol	Oriental fruit fly
6	Sinigrin	Cabbage butterfly
7	Cinnamaldehyde	Spotted cucumber beetle

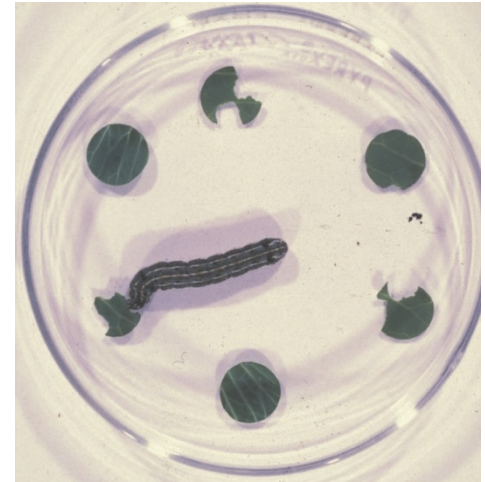


# Antifeedants

- Chemicals which inhibit feeding when present in a place where insects in its absence would feed.

OR

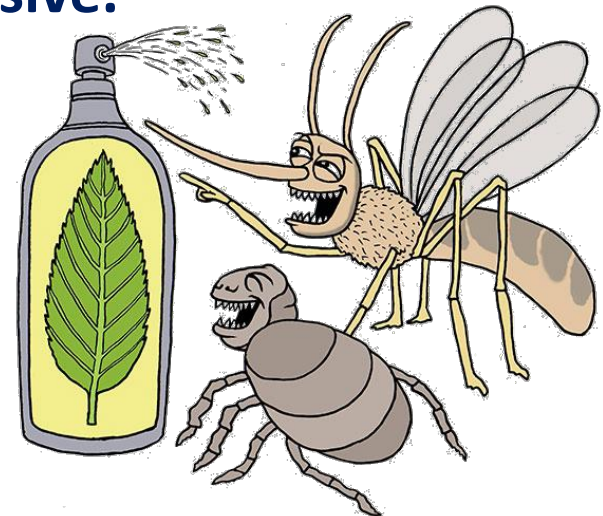
- Chemical compound which prevent feeding of insect or animal on a treated material without necessarily killing or repelling.
- 1<sup>st</sup> antifeedant – Zinc salt of Dimethyl dithiocarbonic acid against rodents and trees- to prevent feeding on bark of trees.



<b>Sl. No.</b>	<b>Antifeedant</b>	<b>Target insects</b>
<b>1</b>	<b>Azadirachtin</b>	<b>Desert locust and other insects</b>
<b>2</b>	<b>Baygon</b>	<b>Cotton boll weevil</b>
<b>3</b>	<b>Brestan</b>	<b>Cut worms and potato tuber moth larvae</b>
<b>4</b>	<b>Chlorinated triphenyl methane and triphenyl sulfonium salts</b>	<b>Phytophagous insects</b>
<b>5</b>	<b>Organotins</b>	<b>Grasshoppers, Agrotis sp.</b>
<b>6</b>	<b>Phlorizin</b>	<b>Myzus persicae</b>
<b>7</b>	<b>Pyrethrum</b>	<b>Glossina sp.</b>
<b>8</b>	<b>Solanine</b>	<b>Potato leaf hopper</b>
<b>9</b>	<b>Thiocarbamates and phenyl carbamates</b>	<b>Beetles</b>
<b>10</b>	<b>Triazines</b>	<b>Cockroaches and beetles</b>

# Repellents

- Chemicals that cause insects to orient their movements away from a source.
- Allied materials that do not cause movement away but do prevent feeding or oviposition by insects- deterrents.
- Repellents- volatile chemicals- activity in the vapour phase.
- Plants- unattractive, unpalatable or offensive.





## List of important synthetic repellents

<b>Sl. No.</b>	<b>Repellents</b>	<b>Insect</b>
<b>1</b>	<b>Benzyl benzoate</b>	<b>Mites</b>
<b>2</b>	<b>Bordeaux mixture</b>	<b>Foliage feeders</b>
<b>3</b>	<b>Creosote</b>	<b>Chinch bugs</b>
<b>4</b>	<b>Diacetyl pthalate</b>	<b>Cattle fleas</b>
<b>5</b>	<b>Dimetyl pthalate</b>	<b>Mosquitoes</b>
<b>6</b>	<b>N, N, diethyl m-toulamide (DEET)</b>	<b>Mosquitoes, fleas, flies</b>
<b>7</b>	<b>Naphtalene balls</b>	<b>Cloth moths</b>
<b>8</b>	<b>N-butylacetanilide</b>	<b>Ticks, fleas</b>
<b>9</b>	<b>Pentachlorophenol</b>	<b>Termites</b>
<b>10</b>	<b>Pine tar oil</b>	<b>Screw worm flies</b>

## **Advantages**

- **Low toxicity-safe to humans, plants and domestic animals.**
- **Protects the desired plants and insects are not killed.**
- **Resistance development- low.**

## **Disadvantages**

- **The need to completely cover all susceptible surfaces with repeated applications**
- **Possibility of increasing infestations on near by untreated surfaces.**

*Thank you*