





# Integrated Disease & Pest Management of Sugarcane Crop

*By:*

*Dr. Zia Ul Hussnain, Zulfqar Waseem Malik, Mushtaq Ahmad,  
M. Umair Farooq & Irshad Ahmad Gill*

**Fatima Sugar Research & Development Centre (FSRDC),  
Fatima Sugar Mills Limited, Kot Addu**

# What is Integrated Disease Management?

- Preventive or curative measures can be put in place to minimize the risk of disease infection and their spread.

# Major Diseases of Sugarcane

<b>Fungal</b>	<b>Bacterial</b>	<b>Viral</b>	<b>Physiological</b>
Red rot	Red Stripe	Mosaic	Banded Chlorosis
Whip smut	Ratoon Stunting	White Leaf	
Rust			
Pokkah Boeng			

# Transmission of Major Diseases

<b>Seed borne</b>	<b>Soil borne</b>	<b>Air borne</b>	<b>Insect contact</b>
Red rot	Red rot	Rust	Red rot
Whip smut	Whip smut	Red Stripe	Mosaic
Mosaic		Pokkah Boeng	

# Effect of Major Diseases on Yield & Recovery%

Diseases	Incidence (%)	Loss % in	
		Yield	Recovery
Red Rot	1-25	29.07	30.80
	26-50	47.60	55.19
	More than 50	74.18	74.52
Whip Smut	10	7.76	3.90
	50	77.81	39.71
Pokkah Boeng	On leaves only	21.00	6.75
	Top rotted	50.12	27.63
Mosaic	Severe	10.12	1.53

# Red Rot of Sugarcane

(*Colletotrichum falcatum* Went)

- Red rot is a fungal disease of the stalk.
- Associated with stress and over-maturity.
- Mostly prevalent in the northern and central regions of Punjab.
- High yielding & good Recovery% varieties have gone out of cultivation.

# Symptoms

- Internal red discoloration of the stalk tissues.
- With white blotches and gray fungal mycelium at the advance stage.
- Translocation of water to leaves is interrupted, which results plant death.
- Rotting often starts at the nodes.
- Rotted stalks die and become mummified.
- The fruiting bodies of the fungus are usually seen on the rind near the nodes in the form of black dots.
- Sometime elongated red lesions on the leaf midrib are noticed.



# Red Rot Affected Cane View



# Transmission

- Through diseased setts taken from diseased canes.
- The disease is spread by wind, rain splash and irrigation water.
- The spores of the fungus may remain viable in field/plant for 75 days.
- The optimum temperature for the growth of the fungus is 25-30 °C.
- Widely spread under humid conditions.

# Management

- Avoid planting of highly susceptible varieties.
- Planting material should be collected from the pure seed nursery.
- Follow a rotation to rotate cane after two years in the same field.
- Avoid ratooning of infected fields.
- Rogue out the affected clumps & destroy it by burning.
- Cane set should be sprayed with fungicide (**Thiophanate methyl**) 500-gm per acre before setts covering at sowing.
- To minimize the severity of the disease, **Thiophanate methyl** 800-gm per acre should be applied 2-3 time through irrigation till the month of September.

# Whip Smut

(*Sporisorium scitaminea*)

## Symptoms

- Long whip like structure appears from apex, with whitish membrane, ruptures to expose spores to healthy canes.
- The whip often elongates to a length of 2-3 feet and curls downward.
- The whip is covered by a layer of dark brown fungal spores.
- Prior to the emergence of whips, smut-infected plants can have a grassy appearance with many small-diameter shoots.

# Transmission

- Spores dispersed in air currents to spread the disease over short and long distances.
- Prevalent in all cane areas.



# Management

- Sets from smutted canes should not be used for planting.
- Smutted plants should be rouged out and burnt before the bursting of the spores.
- Cane set should be sprayed with fungicide (Thiophanate methyl) 400-gm per acre before setts covering at sowing.
- Hot water treatment of setts at 52°C for 20 minutes can help to eliminate the internal infection.



# Pokkah Boeng

(*Fusarium moniliforme*)

## Symptoms

- Associated with red rot in some areas.
- Mild chlorosis of young leaves in early stage.
- Infected leaves show small holes.
- Nodes become dwarf and thin.
- Ladder like appearance.
- In severe case top rot.



## Transmission

- Spore dispersal through air from one field to other or rain splashes.
- May be through diseased seed.

## Management

- Avoid plantation of infected cane.
- Use of healthy seed of resistant varieties.
- Seed treated with the 0.1 % solution of Topsin-M.



# Mosaic

(Sugarcane mosaic virus)

## Symptoms

- The mosaic symptom is most evident in the youngest emerging leaves.
- The mosaic pattern has irregular, pale green, yellowish and green patches on leaves .
- The disease directly affects the photosynthesis and growth of sugarcane.



# Transmission

- The virus persists from year to year in infected plants.
- First through seed.
- Then through insect vector (aphids).
- Seed cutting through unsterilized tools.

# Management

- Virus-free plantlets through tissue culture can eliminate or slow down the incidence of mosaic disease.
- Timely removal of weeds.
- Chemical and biological control of aphids.
- Mosaic free nurseries be maintained.
- Tools being used should be sterilized in 0.1 % Topsin- M / Dettol solutions.

# Rust

(*Puccinia melanocephala*)

- Minor disease in Pakistan.
- Common in autumn crop.
- Bow temperature & humid helps its development in susceptible varieties.



# Transmission

- Rust survives the winter in living green leaf tissue.
- Spores are then produced and aerially dispersed to spread the disease over short and long distances.
- By wind and water splashes.

# Management

- Host plant resistance is the primary control method.
- However, the rust pathogen has the capability to adopt and overcome varietal resistance.
- Once a variety becomes susceptible, rust can be controlled with the application of Nativo 75%Wg @ 65 gm per acre.
- Do not plant susceptible varieties in autumn, as spring planting is sage for such varieties.
- Spray of chemicals is not practicable.

# Transgenic Sugarcane Development

- Already tested technology in world.
- Red rot resistant transgenic sugarcane developed through expression of  $\beta$ -1,3-*glucanase* gene.
- Biotechnology scientist needs to work on transgenic development of eradicated sugarcane varieties having high sucrose contents & yield like SPF-234, CPF-246 & CPF-247 etc.

# Integrated Pest Management (IPM) of Sugarcane

- IPM is an ecosystem-based strategy
- Focus on long-term prevention of pests and their damage
- Combination of techniques such as biological control, modification of cultural practices, chemical application and use of resistant varieties.



# Components of IPM

- Pest identification
- Monitoring and assessing pest population density & damage
- Guidelines for when management action is needed
- Preventing pest problems
- Using a combination of biological, cultural and chemical management tools
- After action is taken, assessing the effect of pest management

# Major Pests of Sugarcane

- Top Borer
- Stem Borer
- Root Borer
- Gurdaspur Borer
- Mites
- Black Bug
- Beetles
- Termites
- Pyrilla
- White Fly
- Aphids
- Grasshopper

# Identification of Sugarcane Borers

Name of Borer	Moth color	Larvae	Pupae	Egg
Top Borer	White, Red tip of female	Creamy with one dark streak on back longitudinally	Brown	Oval & Scale like covered with hairs
Stem Borer	Brownish pale yellow, hind wings whitish	Dirty white with 5 stripes on body longitudinally	Peddish brown	Creamy scale like
Root Borer	Pale yellow brown, hind wings white	Creamy white, head yellow brown	Yellowish	Creamy scale like
Gurdaspur Borer	Dark brown	Creamy white, head with 4 reddish stripes along end side	Yellowish brown	Creamy scale like

# Life Cycle of Sugarcane Borers

Name of Borer	Eggs to Larvae	Larvae to Pupa	Pupa to Adult	Adult to Life	No. of Generation in a year	Active Period
Top Borer	7-9 days	28-35 days	7-10 days	4-5 days	4-5	Feb-Nov
Stem Borer	4-5 days	18-23 days	7-12 days	2-4 days	4-5	Mar-Nov
Root Borer	3-8 days	45-64 days	14-21days	5-7 days	3-4	Apr-Nov
Gurdaspur Borer	9-11 days	40-64 days	6-13 days	4-5 days	2-3	Jul-Oct

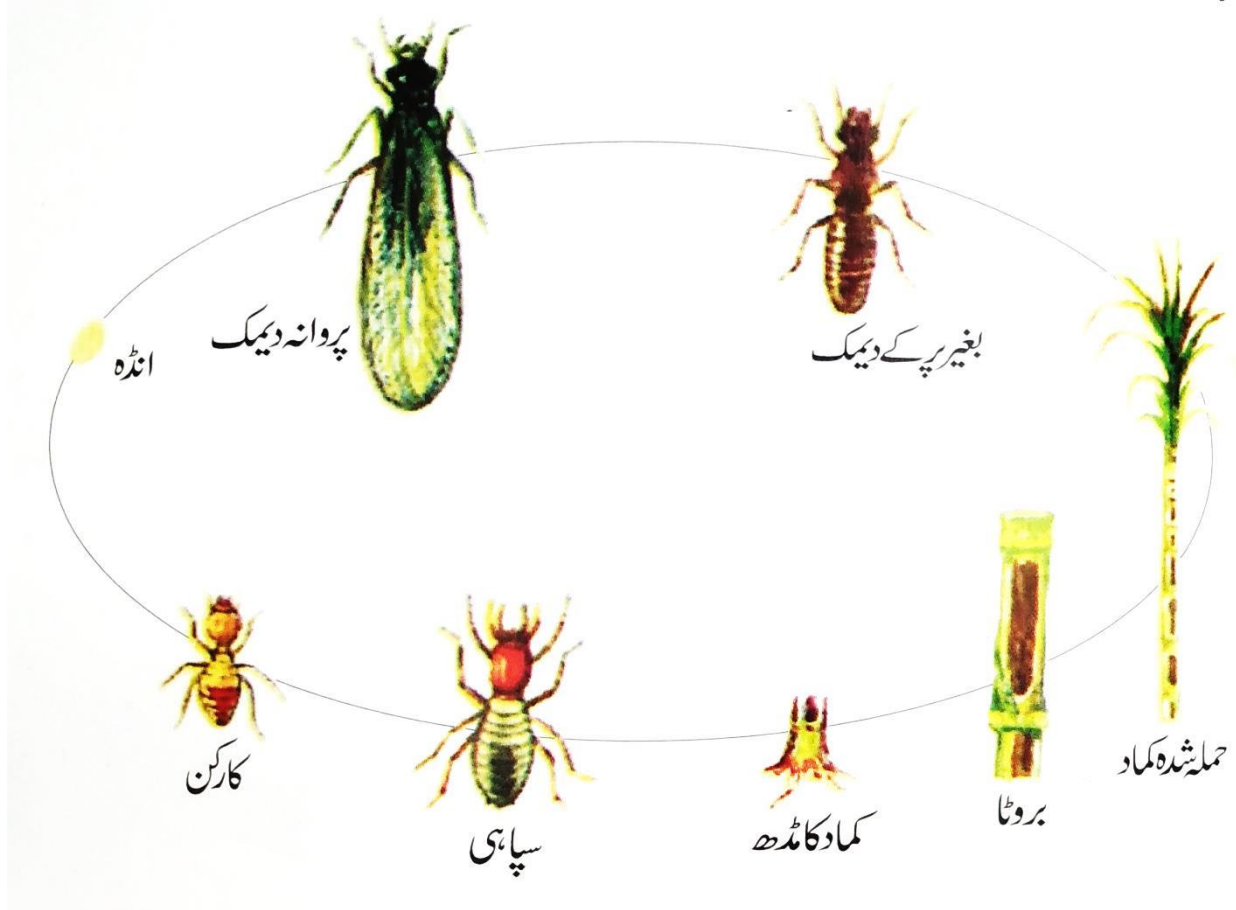
# ETL of Sugarcane Pest

Name of Borer	Economic `Threshold Level
Top Borer	8-10%
Stem Borer	8-10%
Root Borer	8-10%
Gurdaspur Borer	8-10%
Pyrilla	3 / Leaf
Mites	10 / Leaf
Termites	10% Damage
Mealy Bug	3-5 Adults / Sweep of net
Grasshopper (Tokka)	On Appearance
White Fly	10 / Leaf
Black Bug	10 / Sheeth
Roddents	5 Live Burrows / Acre

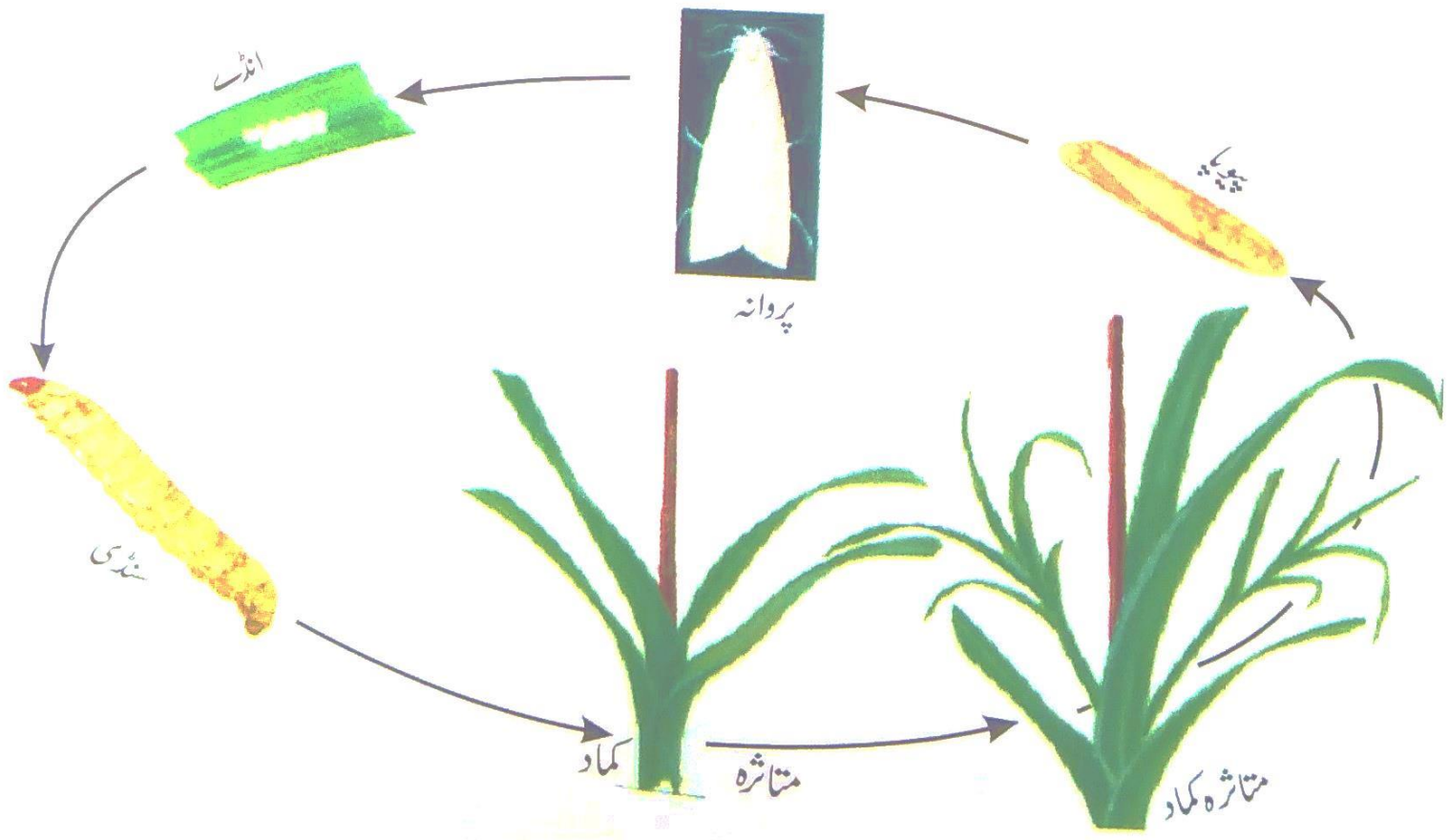
# Production Losses

<b>Name of Borer</b>	<b>% Reduction in Cane Yield (tons/ha)</b>	<b>Reduction in Sugar Recovery %</b>
Top Borer	21-37	0.2 - 4.1
Stem Borer	31-33	1.7 – 3.07
Root Borer	32-35	0.3 – 2.9
Gurdaspur Borer	25-30	0.3 – 2.1
Pyrilla	14.7	2.0 – 3.0
Mites	16-20	0.2 – 1.3
Termites	18-22	2.7 - 4.5
Grasshopper (Tokka)	37-40	2.1 – 4.3
White Fly	80	1.4 – 1.8
Black Bug	31	0.1 – 2.8
Roddents	15-20	0.1 – 1.1

# Life cycle of Termites



# Life Cycle of Top Borer

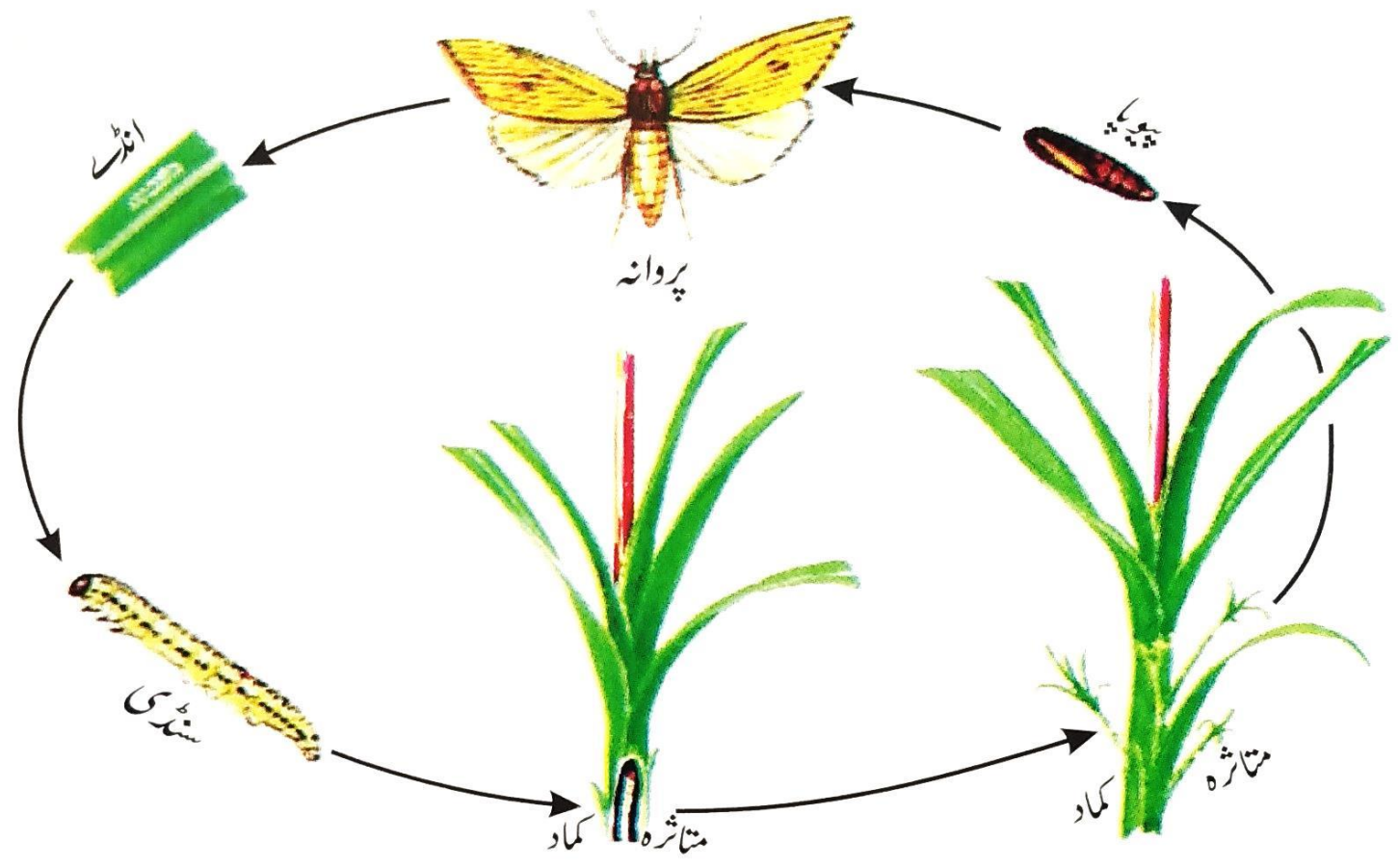




# Top Borer



# Life Cycle of Stem Borer

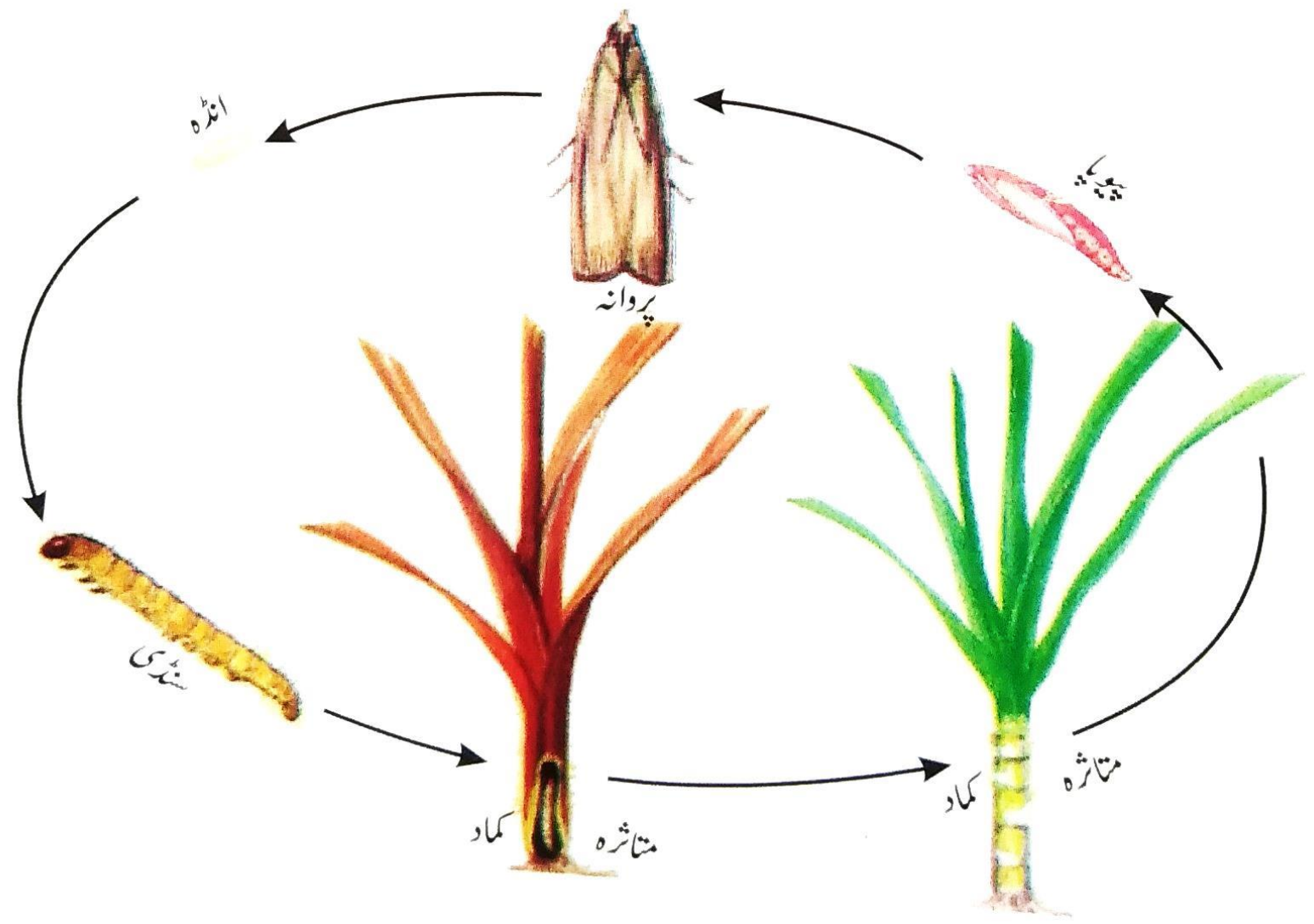




# Stem Borer

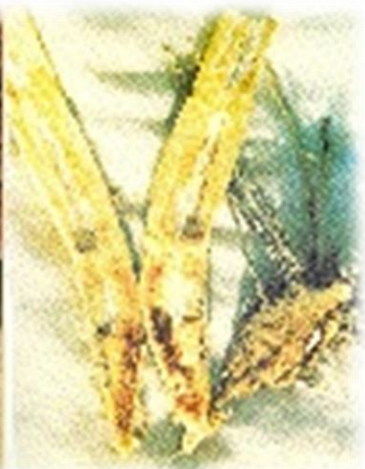
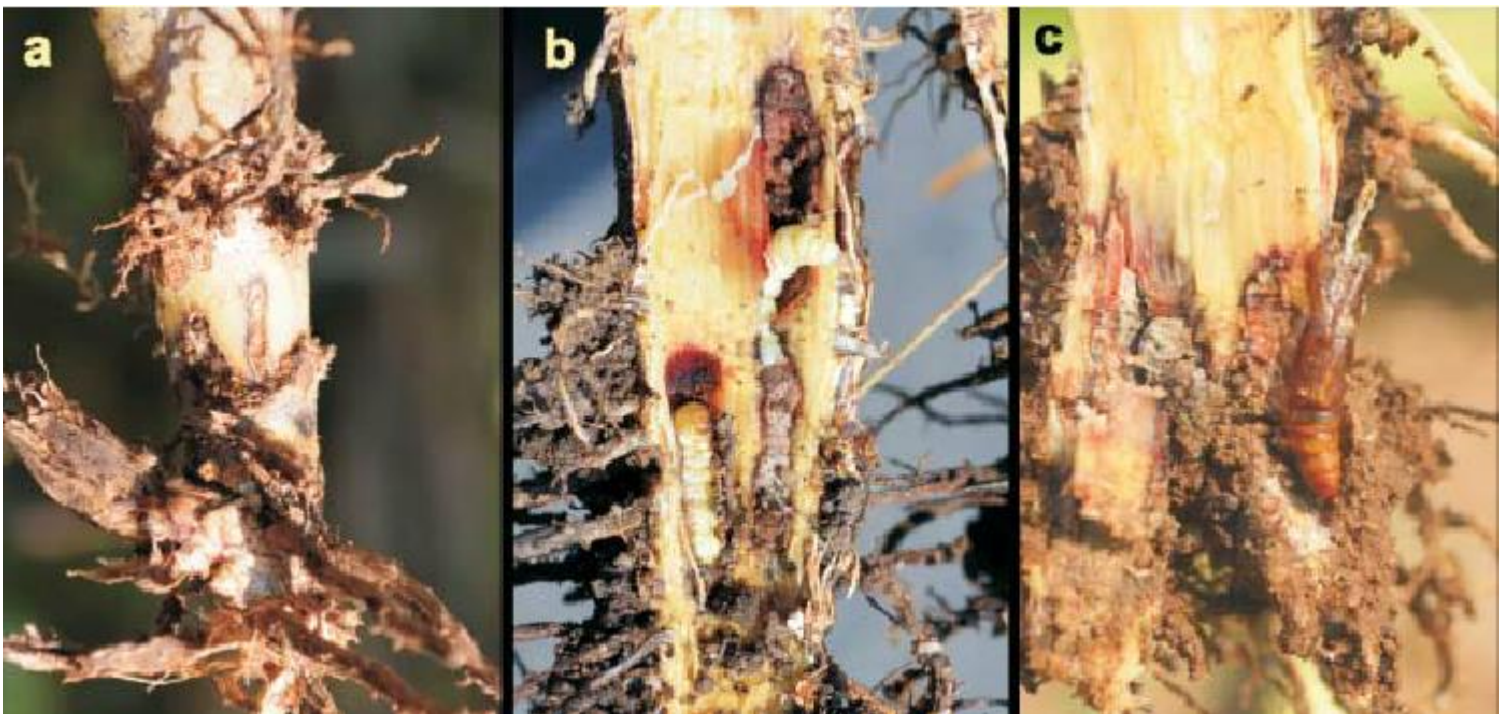


# Life Cycle of Root Borer

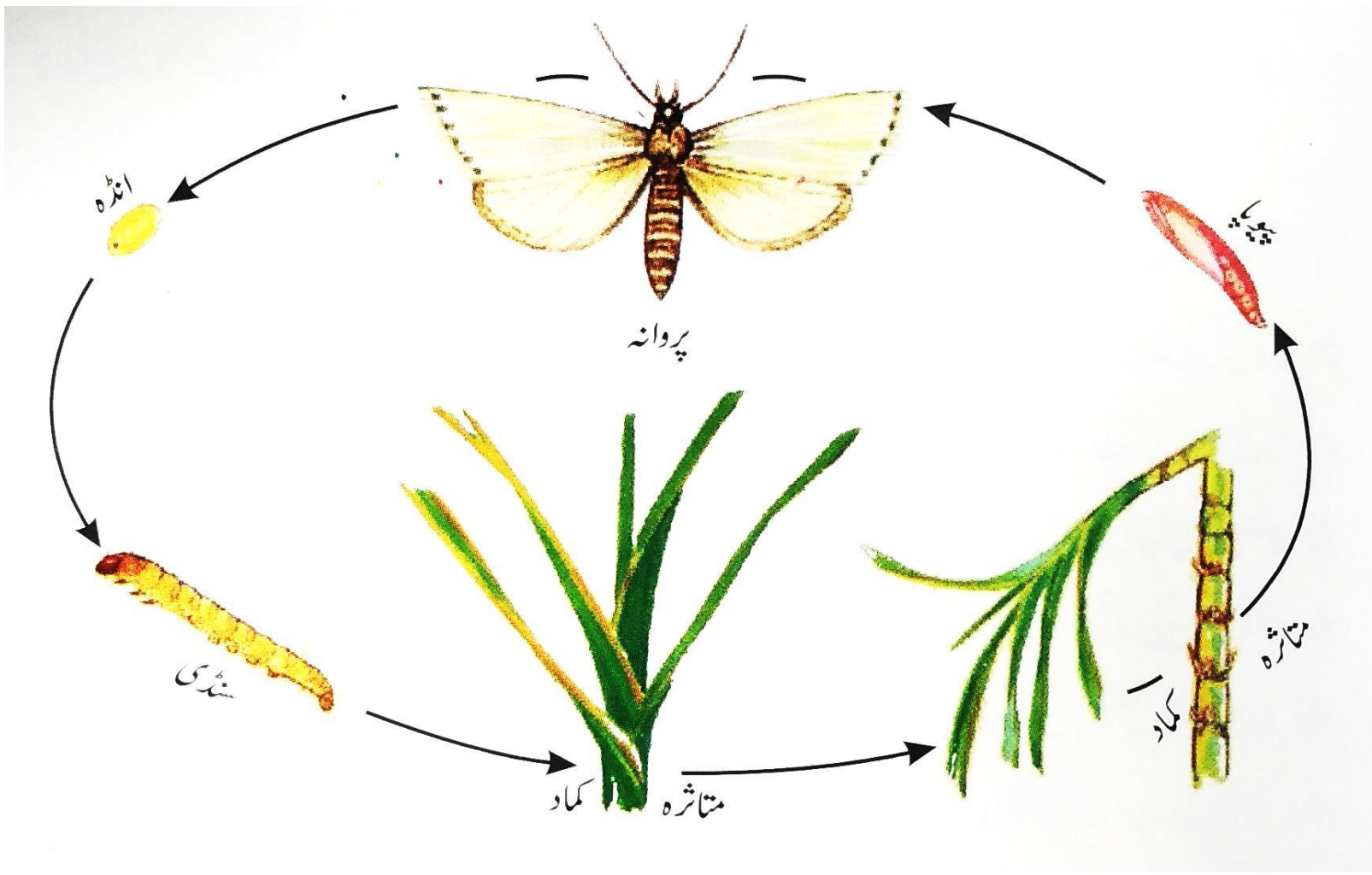




# Root Borer



# Life Cycle of Gurdaspur Borer

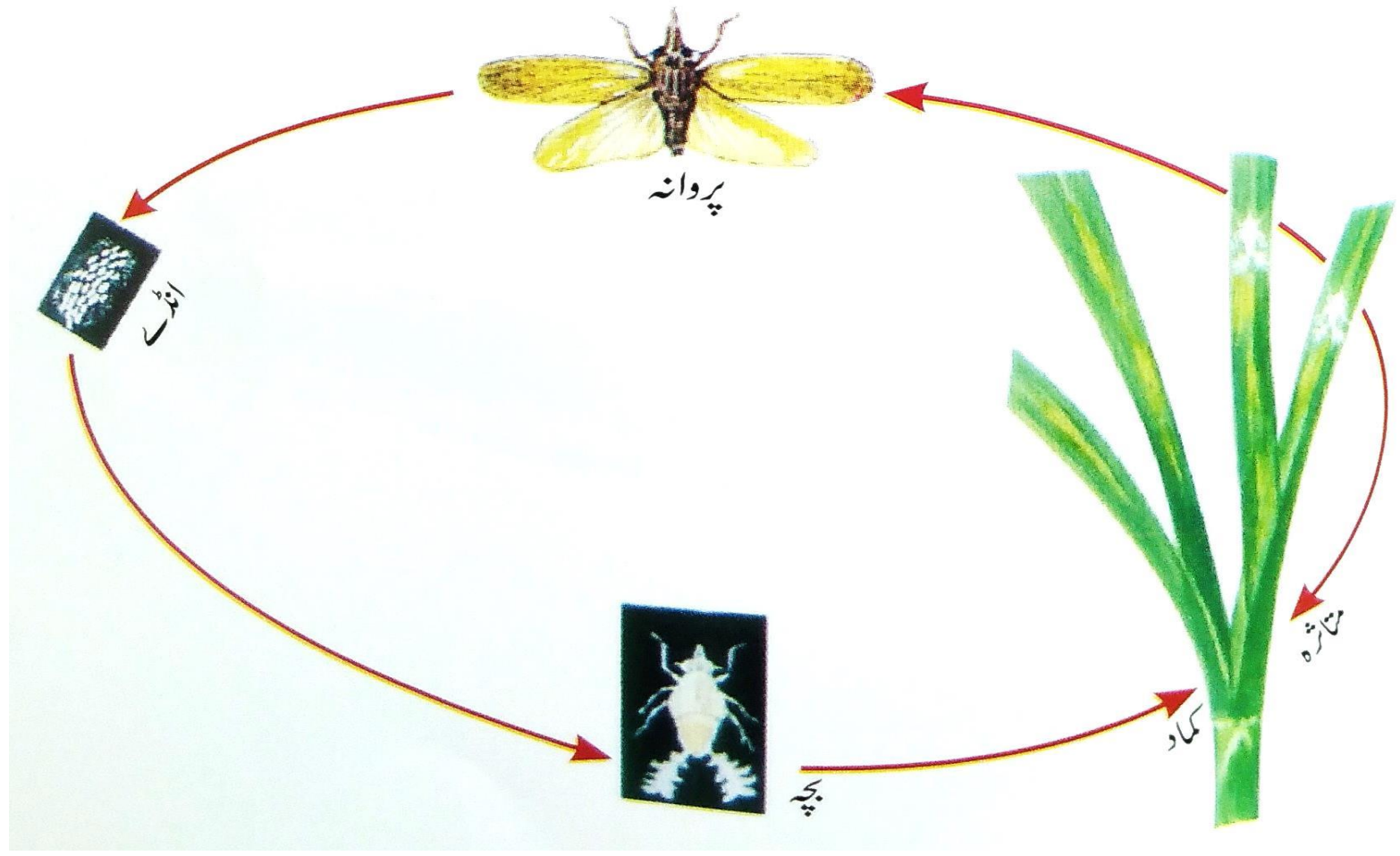




# Gurdaspur Borer



# Life Cycle of Pycnopsocus





# Sugarcane Pyrilla



# Sugarcane White Fly





# Sugarcane Black Bug



# Sugarcane Leaf Mite



# Chemical Control of Sugarcane pests

	Name of Borer	Chemical
Chewing Pest	Top Borer	<ul style="list-style-type: none"> <li>• Fipronil 25% Ec (60 gm / acre)</li> <li>• Chlorantraniliprole 40wg (8 kg / acre)</li> <li>• Bifenthrine 10% Ec (500 ml / acre)</li> <li>• CyperMethrine 10% Ec (1L / acre)</li> <li>• Lambda Cyhalothrine 2.5 % (1 L / acre)</li> <li>• Profenofos 50% Ec (1200 ml / acre)</li> <li>• Chloropyrifos 40% Ec (2 L / acre)</li> </ul>
	Stem Borer	
	Root Borer	
	Gurdaspur Borer	
	Termites	
	Gross hopper (Tokka)	
Sucking Pest	Pyrilla	<ul style="list-style-type: none"> <li>• Fipronil 25% Ec (60 gm / acre)</li> <li>• Chloropyrifos 40% Ec (2 L / acre)</li> <li>• Lambda Cyhalothrine 2.5 % (1 L / acre)</li> <li>• Cypermethrin 10% Ec (1 L / acre)</li> <li>• Bifenthrine 10% Ec (500 ml / acre)</li> <li>• Obiron 24 Sc (300 ml / acre for Mites)</li> </ul>
	Mites	
	Mealy Bug	
	White Fly	
	Black Bug	
Roddents	Rats, Pigs, Jackals	<ul style="list-style-type: none"> <li>• Aluminium phosphide</li> </ul>



زرعی ادویات کی بوتلوں پر  
درج ہدایات پر عمل کریں

# Biological Control of Sugarcane Pests

# Biological Control of Sugarcane Borers

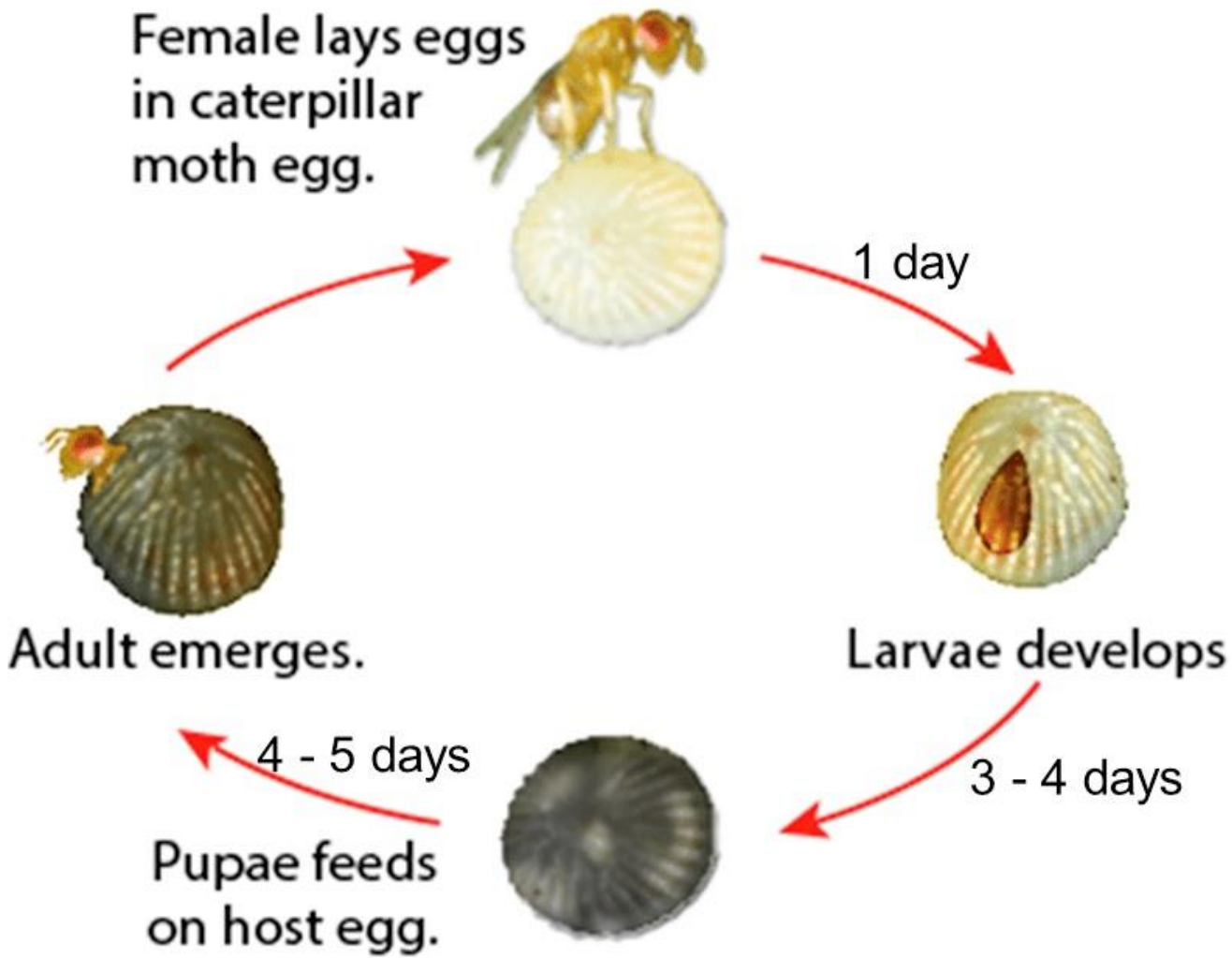
## *Trichogramma chilonis*

- An egg parasite of stem, root, gudaspur & to some extent of top borer.
- Female lays eggs inside the eggs of sugarcane borers.
- After hatching they again attack the eggs of borers.
- Completes its life cycle in 5-8 days





# Life Cycle of *Trichogramma chilonis*



# Biological Control of *Pyrilla perpusilla*



*Tetrastichus pyrillae* parasitizing the eggs of sugarcane top borers

# Biological Control of *Pyrilla perpusilla*



Biological Agent *Epiricania* laying eggs

# Biological Control of White Fly (*Aleurodes barodensis*)

*Chrysoperla carnea* (Green lacewing)





# Biological Control of Sugarcane Mealybug

*Cryptolaemus montrouzieri*  
(mealybug destroyer)



# Drone Spray Technology in Sugarcane

- Different size available i.e. 14 Ltr, 20 Ltr & 55 Ltr.
- 25-50% of fertilizers & pesticides can be utilized through drone.
- More beneficial when sugarcane crop attains height .
- 25-30% increase in yield.
- Savings of time & resources.





*Thank  
You!*