

# Chapter 13 (pg. 107)

## Principles of Pest Management

“The goal of Integrated Pest Management (IPM) is to prevent pests from reaching economically or aesthetically damaging levels with the least risk to people, property, and the environment ”

# Integrated Pest Management

- Does not rely just on pesticides
- Combination of chemical & nonchemical (cultural)
- Helps farmers avoid:
  - Pesticide resistance
  - Pesticide ineffectiveness
  - Pesticide misapplication
    - Wrong rate
    - Wrong timing
    - Off target

# Components of IPM

- **Identify** the pest/understand it's life cycle
- **Monitoring** or Scout for pest
- **Develop IPM program using all control options**
- **Implement** the IPM program
- **Record** activities and results

# Never guess at your pest problems!



Misidentification = Mismanagement

# Monitoring

- measure pest populations and crop damage

- Scouting and

- Models used for



activity



# **Economic Threshold**

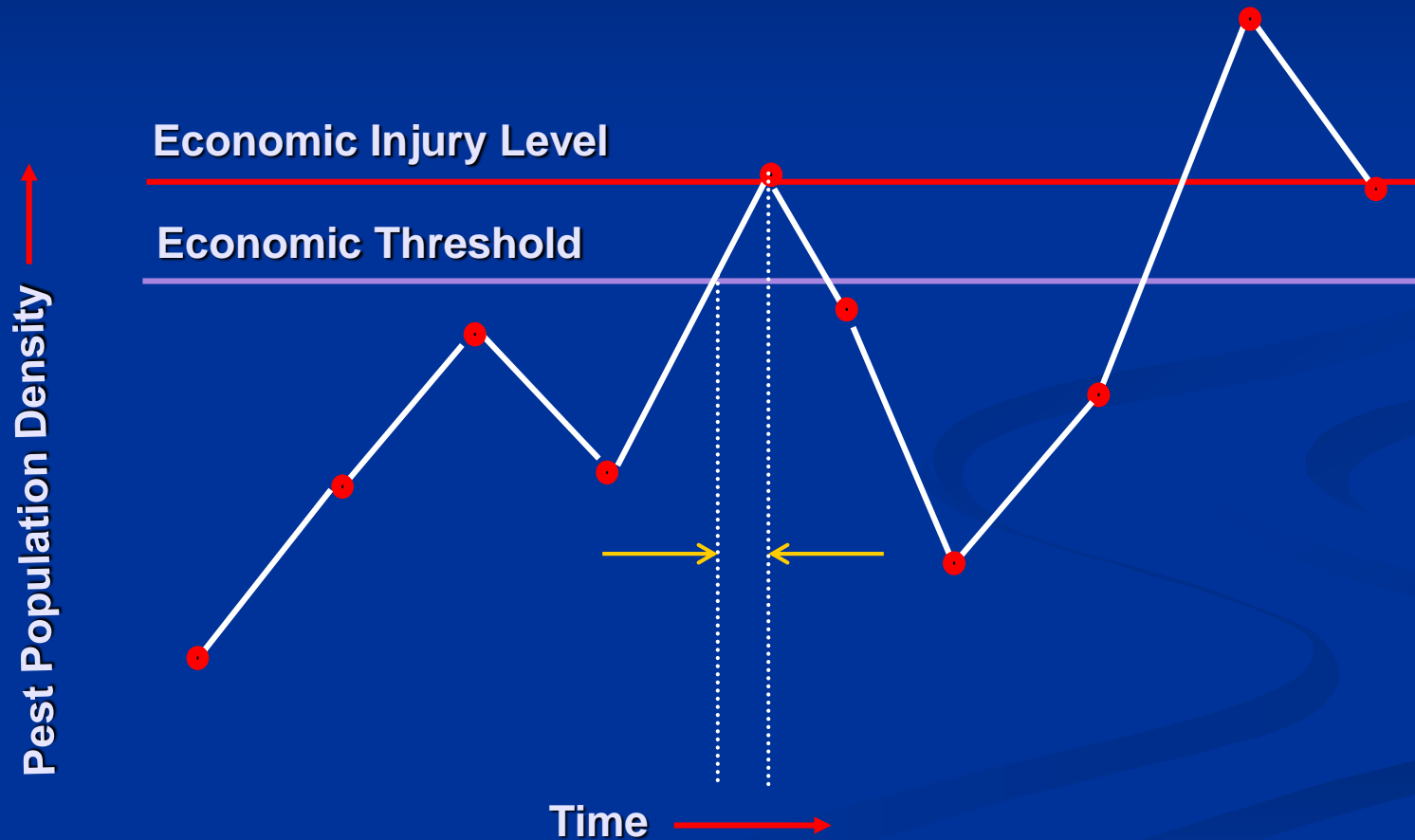
The level of pest density at which control measures are justified

# **Economic Injury Level**

The level of pest density that losses are equal to cost of control measures.

# Economic Threshold

Pest density at which a control measure must be taken to prevent the pest from reaching the EIL



# Action Thresholds

- More appropriate outside of agriculture
- Pest level at which control is warranted for reasons other than just economics
- Threshold may be zero
  - Bedbugs
  - Wasps and bees – allergies
  - Aesthetics in a nursery



# Methods of Pest Management

## ■ Natural Controls

- Climate – temperature, rain
- Topographic – rivers, lakes, mountains
- Natural enemies – regulate pests

## ■ Biological Controls

- Mass releases of natural enemies
- Directed against exotic pests

## ■ Mechanical Control

- Cultivation, exclusion, and trapping

# Methods of Pest Management

## ■ Cultural Controls

- Cultural practices – mulching, cover crops
- Sanitation – eliminate pest's necessities

## ■ Physical Controls

- Refrigeration, humidity, airflow

## ■ Bred Resistance /Genetic Control

- Resistance through crossing
- Resistance through gene transfer, Bt

# Methods of Pest Management

## ■ Chemical Controls

- Often play a key role
- Effective and quick acting
- Reasonable cost
- Challenges with consumers/resistance/environment

## ■ Regulatory Controls

- Exotic pests are targeted
- Quarantine – prevents the spread of pests
- Eradication – total elimination

# To meet the IPM Goal

- **Prevention: Pest is not yet a problem**
  - Resistant varieties, treated seed, pre-emergence herbicides
- **Suppression: Reduce pest to tolerable levels**
  - Goal of pesticide applications, biological control
- **Eradication: Eliminating the pest**
  - Small confined areas, mice/cockroaches
  - Rarely successful in the field!

# Implement an IPM Program

- Coordinate multiple tactics into a single integrated system
- Chemical and non-chemical
- Evaluate costs, benefits, and risks
- Most effective and least harmful

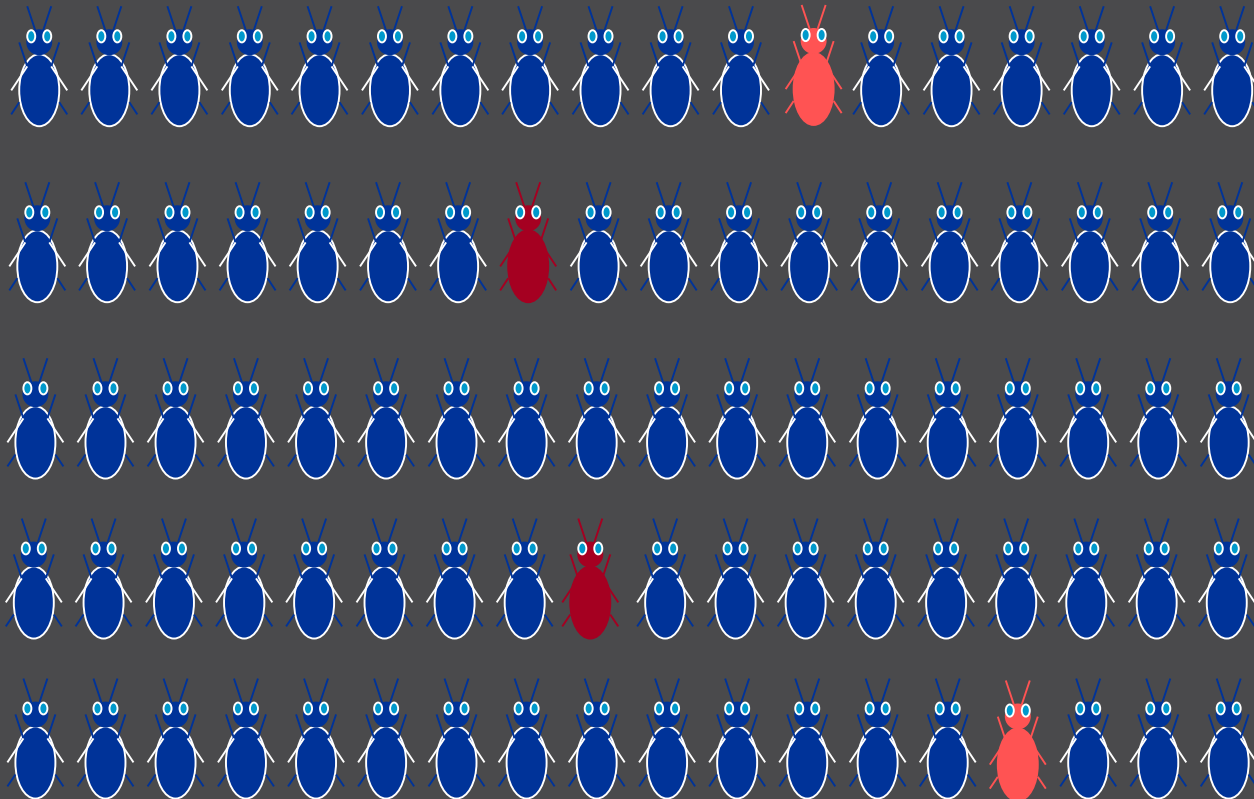
# Chapter 12 (pg. 101)

## Pesticide Resistance

- Pesticide Resistance: Inherited ability of a pest to avoid toxic effects when exposed to a particular pesticide.
- You have lost a tool for managing the pest
- How does pesticide resistance develop?
  - Mutations
  - Passed on to offspring
  - Susceptible all die off

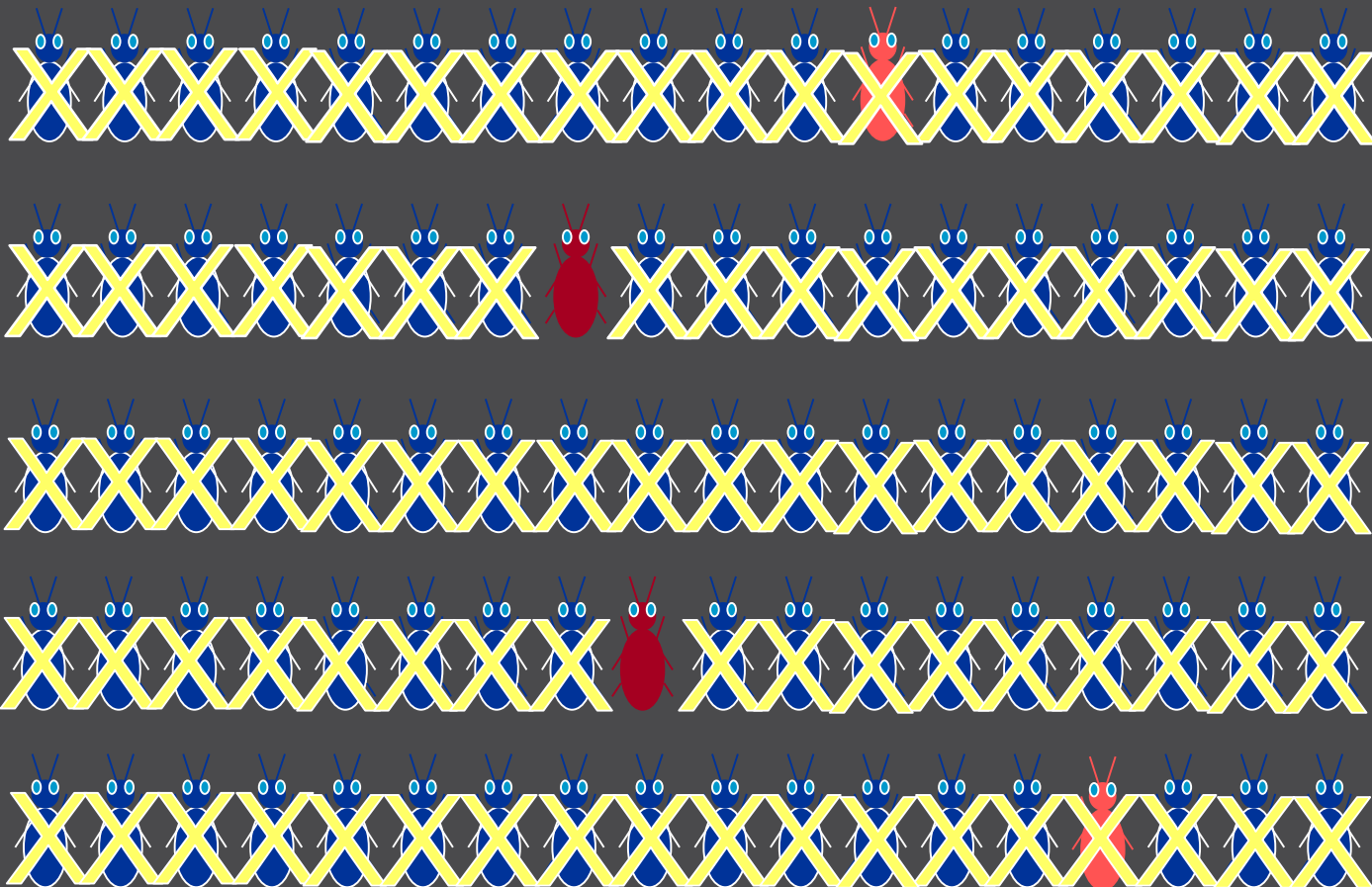
# Natural pest population

- Some individuals have genes that make them less sensitive to a pesticide



# Pesticide application

- Individuals that are susceptible die



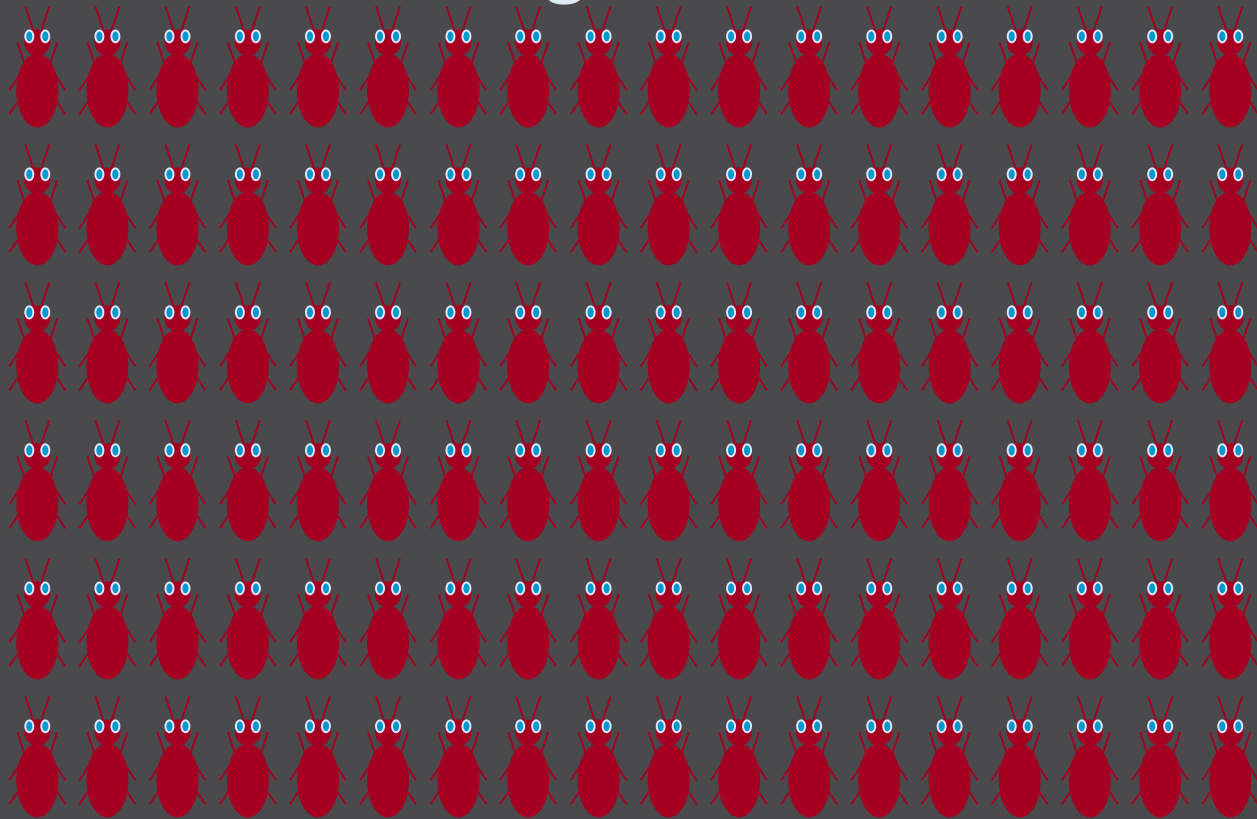


# Pesticide application

- Individuals with naturally occurring genes that make them less sensitive to a pesticide survive...



- Eventually, the population is mostly made up of resistant individuals.
- Under permanent selection pressure, resistant insects outnumber susceptible ones and the insecticide is no longer effective.



# Mechanisms of Pesticide Resistance

1. Reduced uptake
2. Metabolic resistance
3. Target site insensitivity
4. Behavioral change

# Factors that Influence Resistance

1. Number of resistant individuals in population
2. Proportion of the population exposed to the pesticide **More = faster resistance**
3. Pest's life cycle. **More generations per year = faster resistance (insects vs. weeds)**
4. Diversity of pesticides you use
5. Mode of action: **specificity = quicker**
6. Persistence and frequency of use

# Foundations of Resistance Management

- Use an IPM program: multiple control methods = slow resistance development
- Use pesticides only when needed
- Apply pesticides at the labeled rate
- Rotate different modes of action
  - Group number listed on front of label

# Insecticides - IRAC codes

Based on site of action

IRAC MoA Classification Version 8.1, April 2016		
See section 7.4 for further information on sub-groups. See section 7.3 for criteria for descriptors of the quality of MoA information.		
Main Group and Primary Site of Action	Chemical Sub-group or exemplifying Active Ingredient	Active Ingredients
<b>1</b> <b>Acetylcholinesterase (AChE) inhibitors</b>  Nerve action  {Strong evidence that action at this protein is responsible for insecticidal effects}	<b>1A</b> Carbamates	Alanycarb, Aldicarb, Bendiocarb, Benfuracarb, Butocarboxim, Butoxycarboxim, Carbaryl, Carbofuran, Carbosulfan, Ethiofencarb, Fenobucarb, Formetanate, Furathiocarb, Isoprocarb, Methiocarb, Methomyl, Metolcarb, Oxamyl, Pirimicarb, Propoxur, Thiodicarb, Thiofanox, Triazamate, Trimethacarb, XMC, Xyllycarb
	<b>1B</b> Organophosphates	Acephate, Azamethiphos, Azinphos-ethyl, Azinphos-methyl, Cadusafos, Chlorethoxyfos, Chlorfenvinphos, Chlormephos, Chlorpyrifos, Chlorpyrifos-methyl, Coumaphos, Cyanophos, Demeton-S-methyl, Diazinon, Dichlorvos/ DDVP, Dicrotophos, Dimethoate, Dimethylvinphos, Disulfoton, EPN, Ethion, Ethoprophos, Famphur, Fenamiphos, Fenitrothion, Fenthion, Fosthiazate, Heptenophos, Imicyafos, Isofenphos, Isopropyl O-(methoxyaminothio-phosphoryl) salicylate, Isoxathion, Malathion, Mecarbam, Methamidophos, Methidathion, Mevinphos, Monocrotophos, Naled, Omethoate, Oxydemeton-methyl, Parathion, Parathion-methyl, Phenthoate, Phorate, Phosalone, Phosmet, Phosphamidon, Phoxim, Pirimiphos- methyl, Profenofos, Propetamphos, Prothiofos, Pyraclofos, Pyridaphenthion, Quinalphos, Sulfotep, Tebupirimfos, Temephos, Terbufos, Tetrachlorvinphos, Thiometon, Triazophos, Trichlorfon, Vamidothion
		Chlordane, Endosulfan
	<b>2B</b> Phenylpyrazoles (Fiproles)	Ethiprole, Fipronil

GROUP 1B INSECTICIDE

**LORSBAN® 75WG**  
**Insecticide**

For control of listed insects infesting certain field, fruit, nut, and vegetable crops.

ACTIVE INGREDIENT:  
 Chlorpyrifos: O,O-diethyl O-(3,5,6-trichloro-2 pyridinyl) phosphorothioate ..... 75.0%  
 OTHER INGREDIENTS ..... 25.0%  
 TOTAL ..... 100.0%

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### Midgut

#### *Group 11 Microbial disruptors of insect midgut membranes*

The midgut is the target for the toxins produced by the bacterium *Bacillus thuringiensis* (Bt). Bt toxins cause fatal lesions in the midgut wall. Transgenic crops such as Bt-cotton express high levels of specific Bt toxins. Sprayable Bt also contains such toxins.

### Stimulatory Nervous System

The nervous system is the target for most current insecticides, but within this system are many target sites. Insecticides with specific modes of action act at these targets:

#### *Group 1 Acetylcholinesterase (AChE) inhibitors*

Carbamates and Organophosphates act as inhibitors of AChE at nerve synapses. This results in hyperactivity in the nervous system.

#### *Group 4 Acetylcholine receptor agonists / antagonists*

The Chloronicotinyls act as agonists of acetylcholine at the post-synaptic nicotinic ACh receptor (nAChR). This leads to neuronal overstimulation and hyperactivity.

#### *Group 5 Acetylcholine receptor modulators*

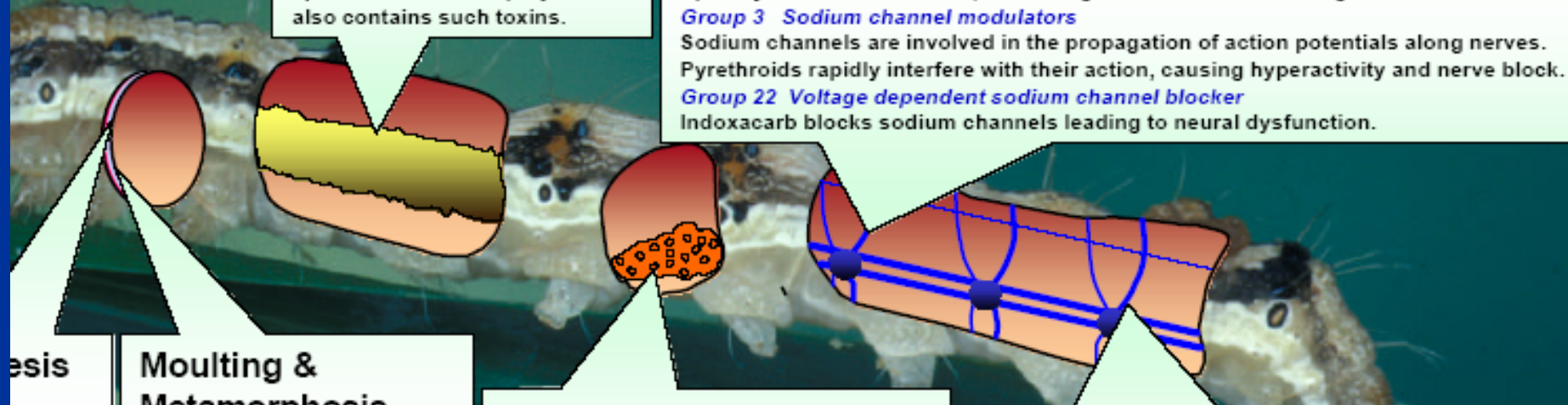
Spinosyns act at the nAChR, interfering with normal functioning.

#### *Group 3 Sodium channel modulators*

Sodium channels are involved in the propagation of action potentials along nerves. Pyrethroids rapidly interfere with their action, causing hyperactivity and nerve block.

#### *Group 22 Voltage dependent sodium channel blocker*

Indoxacarb blocks sodium channels leading to neural dysfunction.



esis

Moulting &  
Metamorphosis