



# Efficacy of Plinazolin for Tarnished Plant Bug Control

James Villegas, LSU AgCenter Entomologist

2024 Louisiana Agricultural Technology & Management Conference, Feb. 8

# Insecticides for TPB Control

- Acephate – Orthene
- Dicrotophos – Bidrin
- Novaluron – Diamond
- Sulfoxaflor – Transform
- Flonicamid – Carbine
- Malathion – Fyfanon
- Thiamethoxam – Centric
- Imidacloprid – Admire Pro/other brand
- Acetamiprid – Strafer Max
- Clothianidin – Belay
- Oxamyl – Vydate

# IRAC – Mode of Action Classification

## Group 1

1A	1B
Oxamyl	Acephate
	Dicrotophos
	Malathion

## Group 4

4A	4C
Thiamethoxam	Sulfoxaflor
Imidacloprid	
Acetamiprid	
Clothianidin	

## Group 15

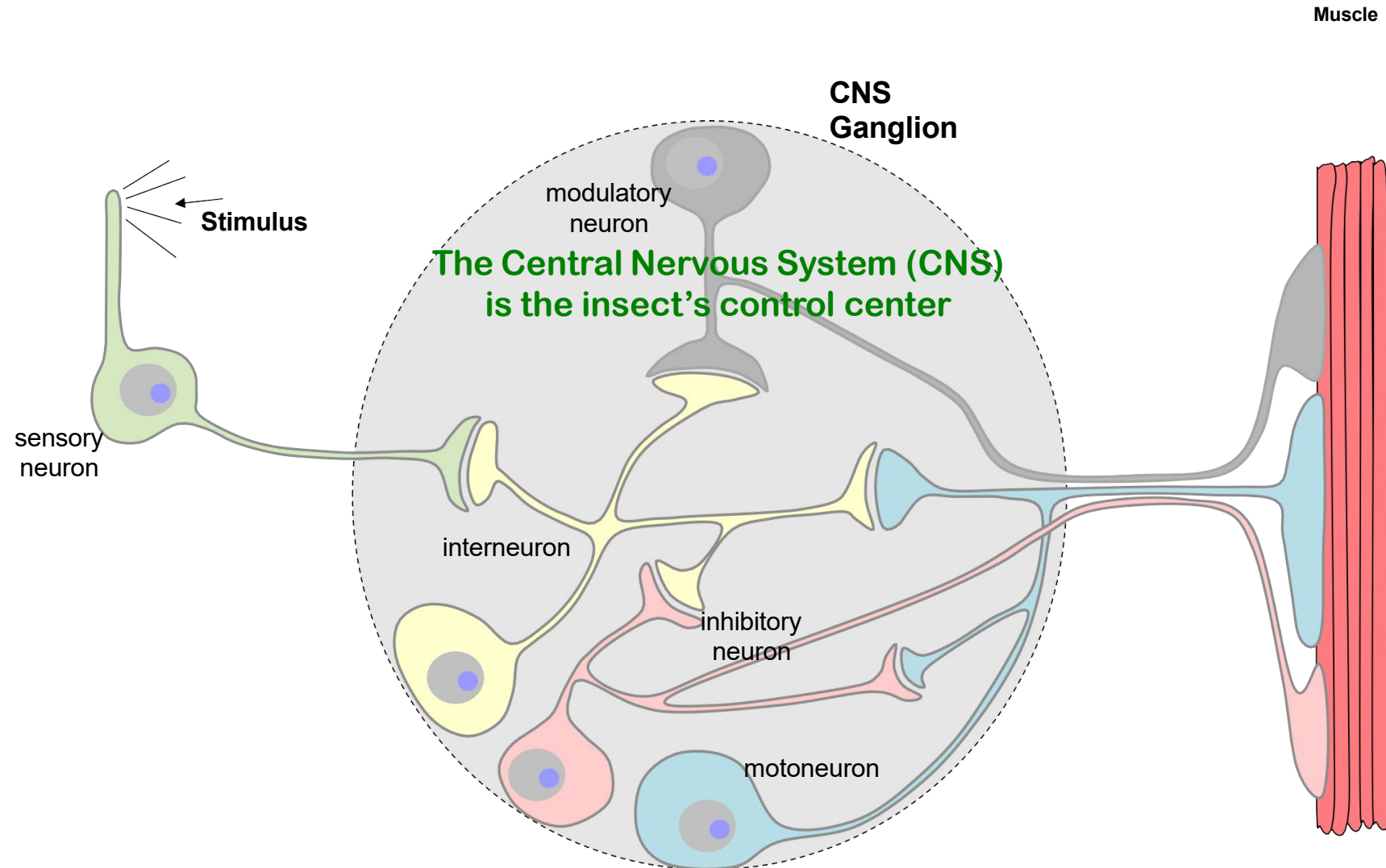
Novaluron

## Group 29

Flonicamid

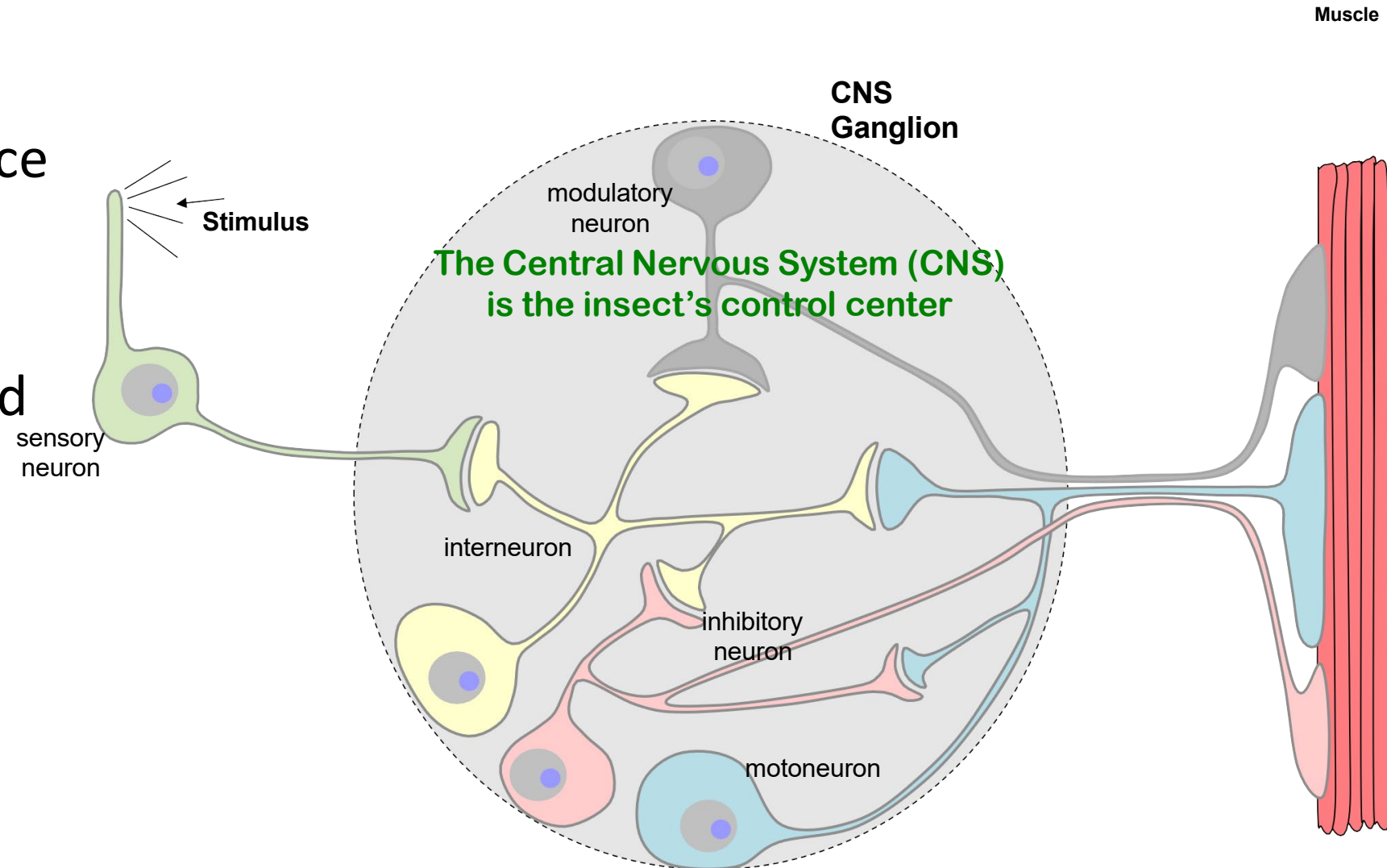
# Nervous System is a Great Target Site

- Disruptions are lethal
- Lots of targets
- Effects are rapid



# Nervous System is also a terrible target site

- Lethality leads to selection and resistance
- Target sites are non-selective
- “Rapid” is the standard



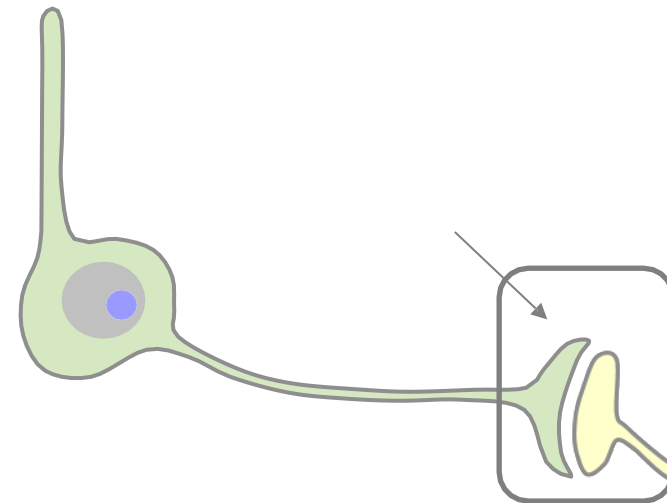
# Insecticides acting on nicotinic Acetylcholine receptors (nAChR)

## 4A - Neonicotinoids

- Thiamethoxam – Centric
- Imidacloprid – Admire Pro/Other Brands
- Acetamiprid – Strafer Max
- Clothianidin – Belay

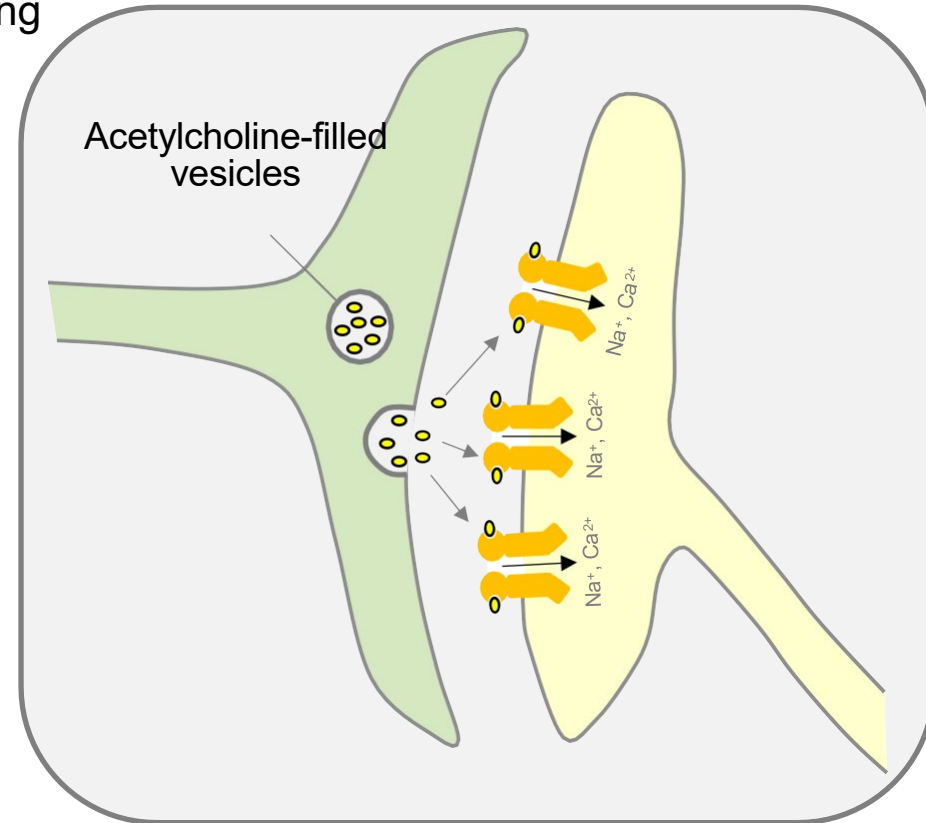
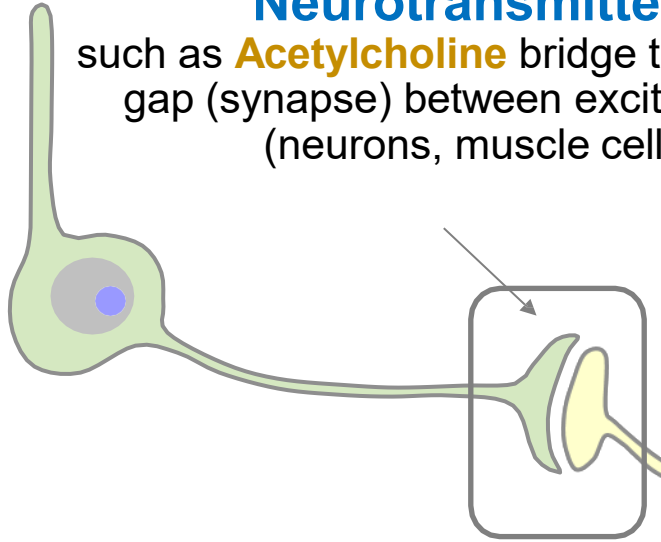
## 4C – Sulfoximines

- Sulfoxaflor - Transform



## Neurotransmitters

such as **Acetylcholine** bridge the signaling gap (synapse) between excitable cells (neurons, muscle cells)



- Most fast excitatory synapses in the insect CNS use **Acetylcholine** as the neurotransmitter
- Synaptic vesicles store **Acetylcholine** that can be released into the synapse in response to nerve impulses and in turn activate postsynaptic nAChRs

# Group 4 (A – E)

## nAChR competitive modulators

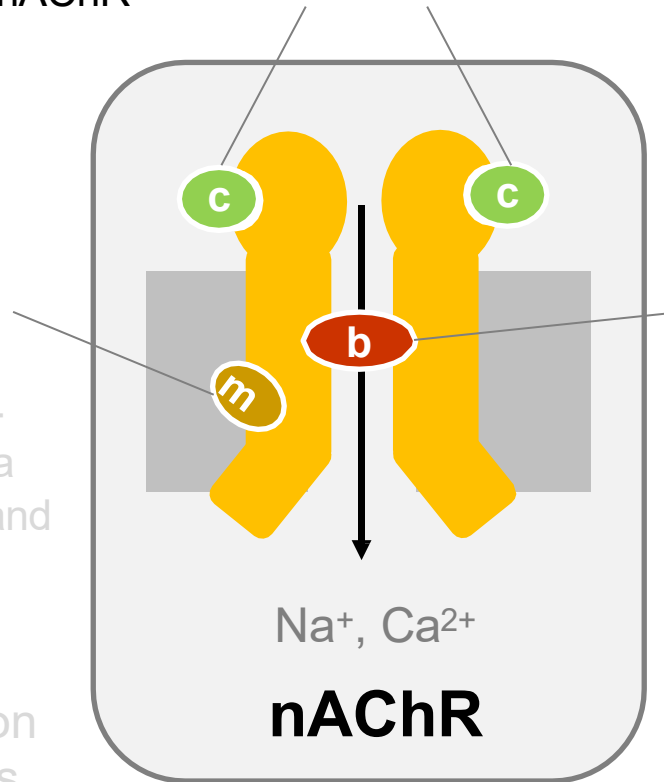
- Bind to the same site as acetylcholine
- desensitize nAChR

Can cause hyperexcitation and/or inhibitory paralysis

## nAChR allosteric modulators

- Bind to the acetylcholine-opened channel form at a different (allosteric) site and keep channels open

Can cause hyperexcitation and contractive paralysis



## nAChR channel blockers

- Obstruct the pore and prevent ion flow
- prevent acetylcholine signal transduction

Can cause flaccid paralysis



# Insecticides acting on enzymes

## 1A - Carbamates

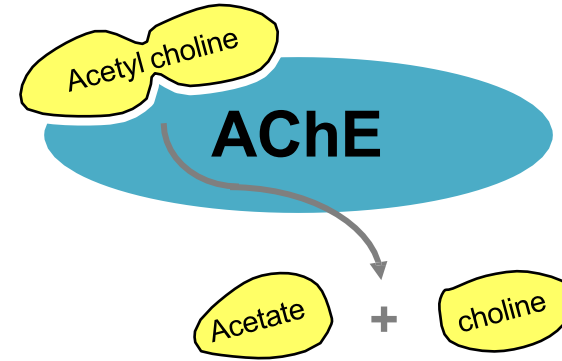
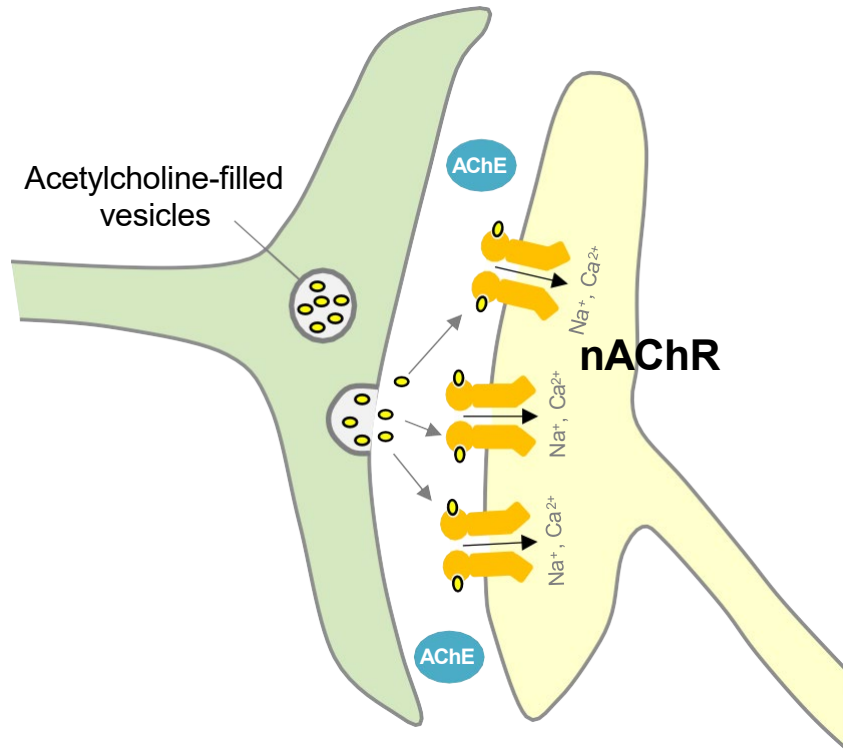
- Oxamyl - Vydate

## 1B - Organophosphates

- Acephate – Orthene
- Dicrotophos – Bidrin
- Malathion – Fynanon

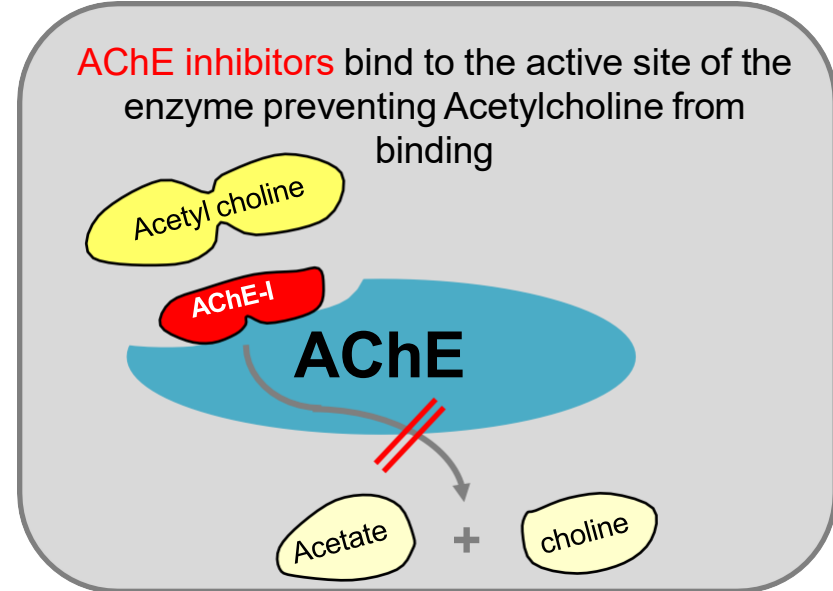
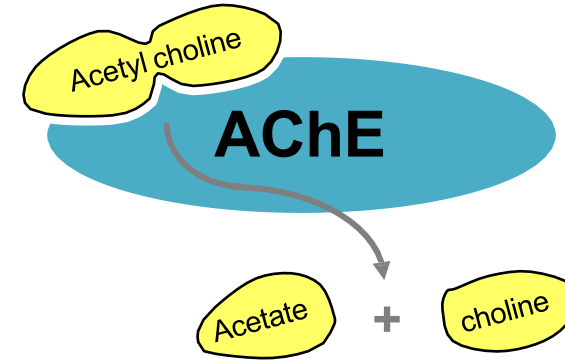
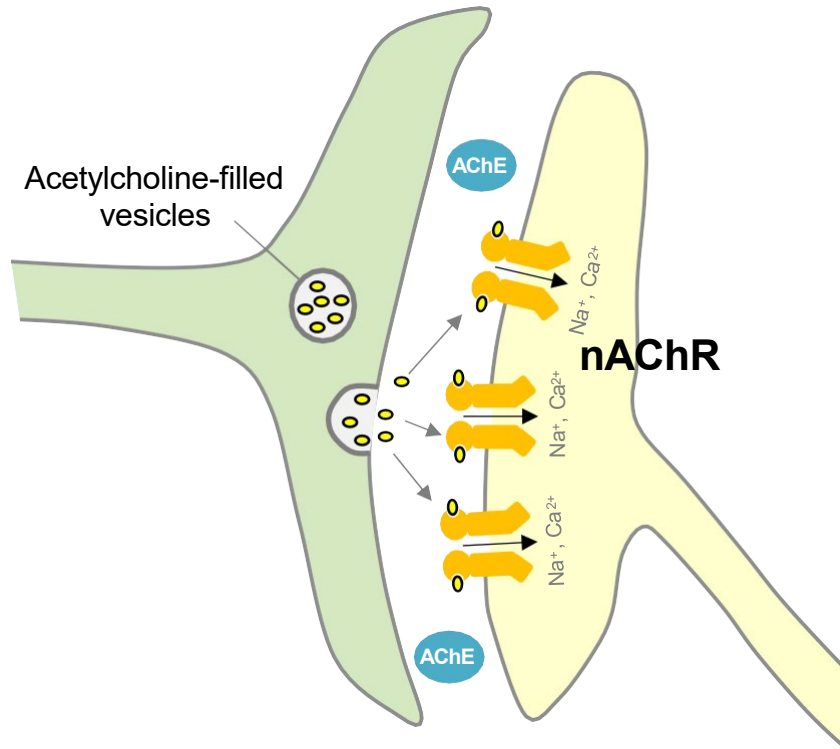
# Acetylcholinesterase (AChE) degrades Acetylcholine in the synapse

**Acetylcholinesterases** degrade **Acetylcholine** in order to terminate the signal after it has been sent across the synapse



# Acetylcholinesterase (AChE) degrades Acetylcholine in the synapse

**Acetylcholinesterases** degrade **Acetylcholine** in order to terminate the signal after it has been sent across the synapse



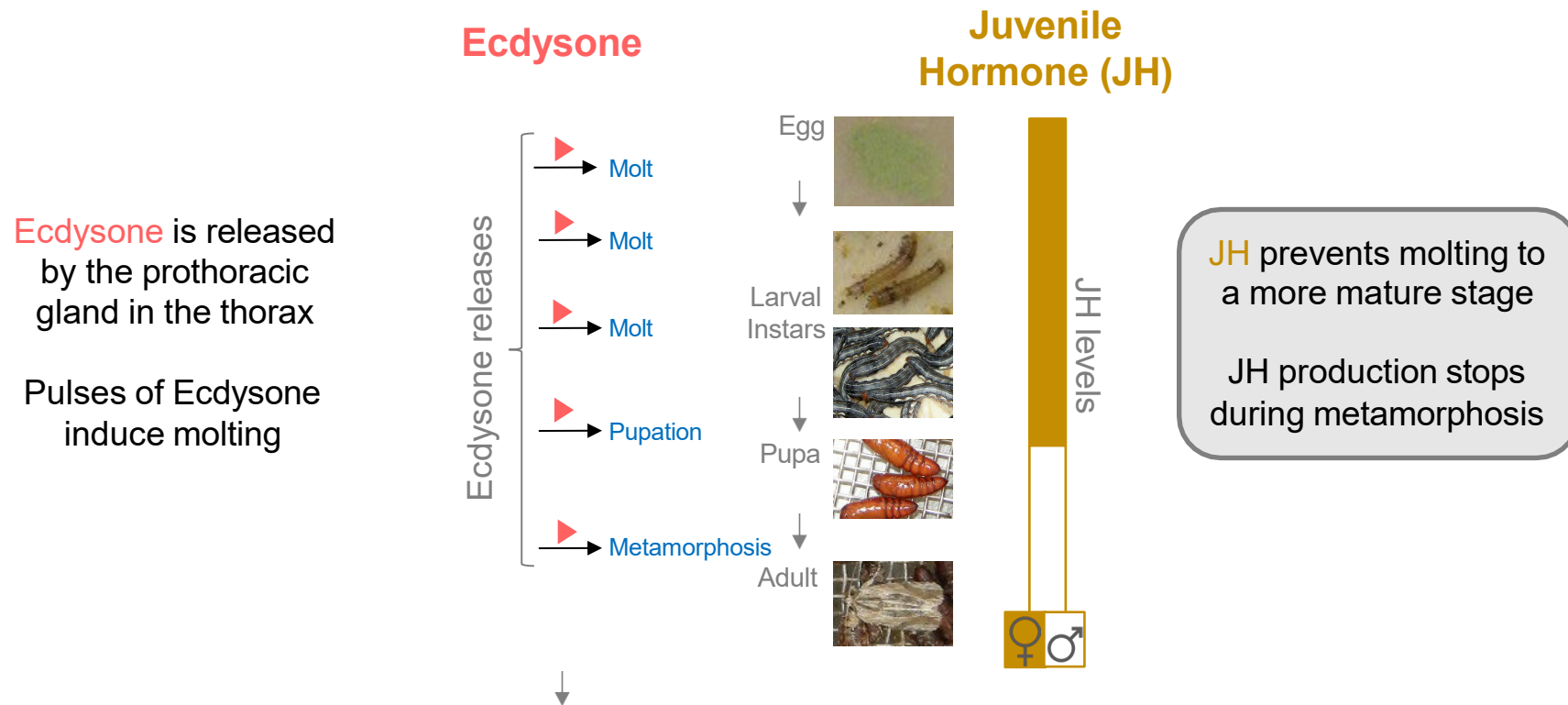
**Group 1**

# Group 29 - Flonicamid

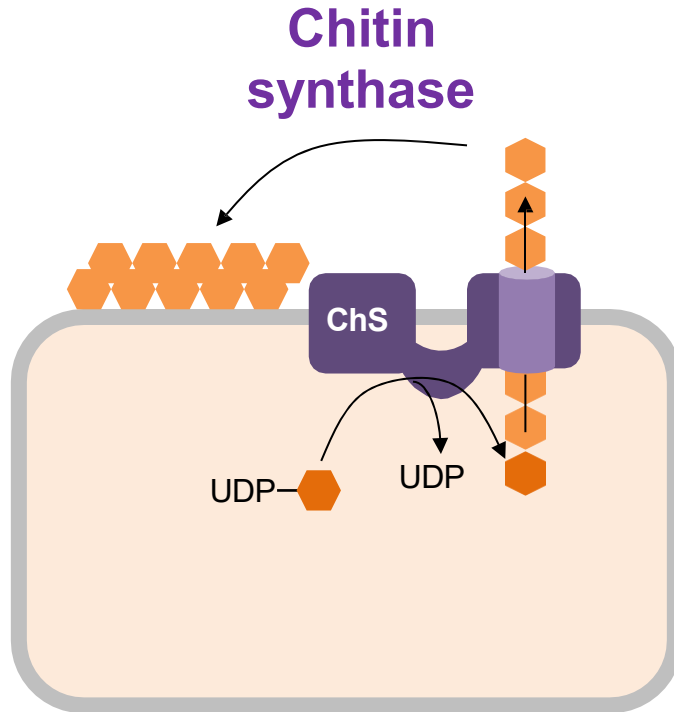
- Target site undefined, but symptoms similar to transient receptor potential cation vanilloid (TRPV) channel which plays an important role in insect stretch receptor.
- Modulation of this channel leaves insects deaf and uncoordinated resulting in rapid feeding cessation, leading to starvation and death.



# Group 15 – Benzoylureas (Novaluron) Growth and Development Disruptor

The insect's skeleton is external (**exoskeleton**) and contains chitin. Since the exoskeleton cannot expand, it must be replaced with a larger one by the process of molting as the insect grows, requiring **chitin synthesis**. Molting is under strict hormonal control:



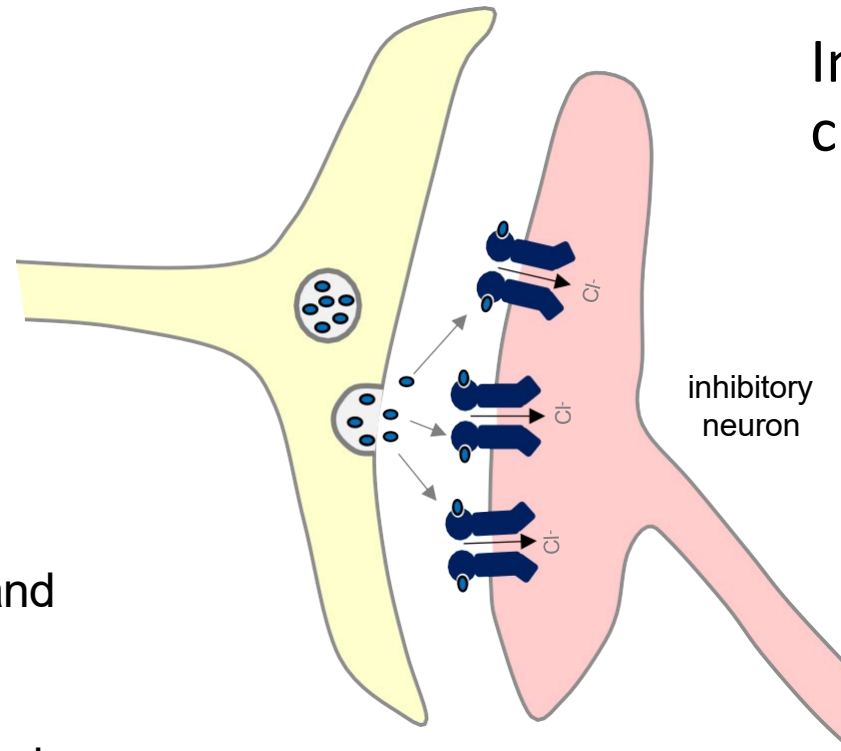
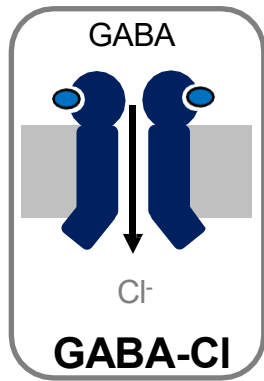
# Group 15 – Benzoylureas (Novaluron) Growth and Development Disruptor



- Chitin is a polymer of N-Acetyl glucosamine (NAcGlc; )
- Chitin synthase uses activated NAcGlc (UDP-NAcGlc; UDP-) to extend the growing chitin chain
- The nascent chain is released into the extracellular space
- Interfering with chitin synthesis results in a weak and soft exoskeleton as well as deformed appendages and sexual organs

# Group 30 - Isoxazolines

- Isocyloseram - Plinazolin



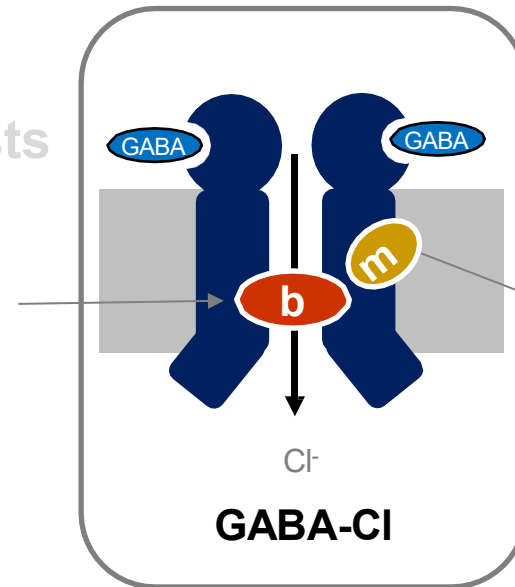
Insecticide acting on GABA-gated chloride channels (GABA-Cl)

- GABA is a major **inhibitory neurotransmitter** in the CNS and neuromuscular synapses
- Influx of the negatively charged Cl<sup>-</sup> ions has an inhibitory effect, counteracting excitatory signals

# Group 30 - Plinazolin

## GABA-Cl antagonists

- Block the pore and prevent chloride influx, interfering with the channel's inhibitory function



## GABA-Cl allosteric modulators

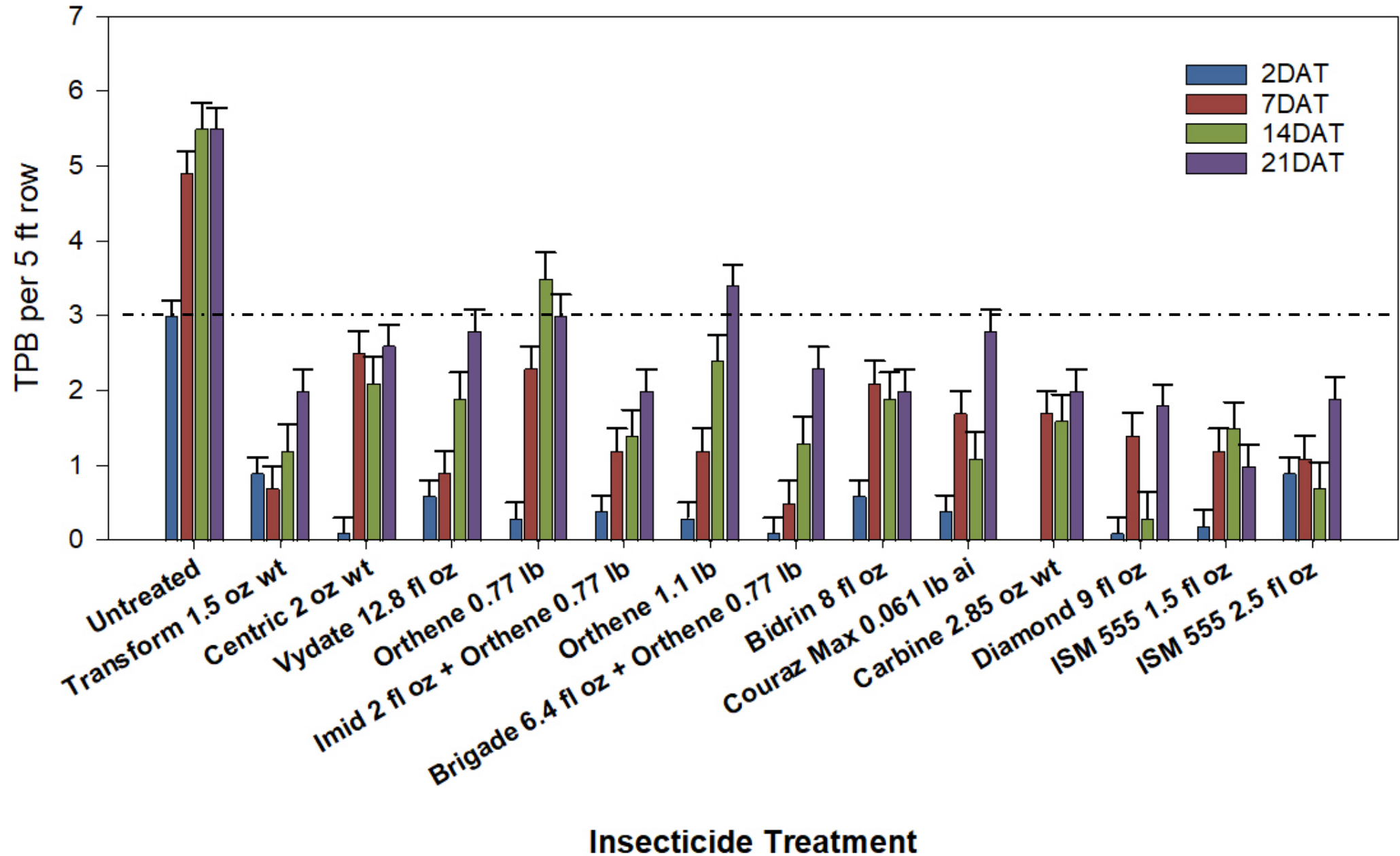
- Binding of modulators negatively affects GABA-Cl, interfering with the channel's inhibitory function

Pore blockers and negative modulators both cause **convulsions** and **death**

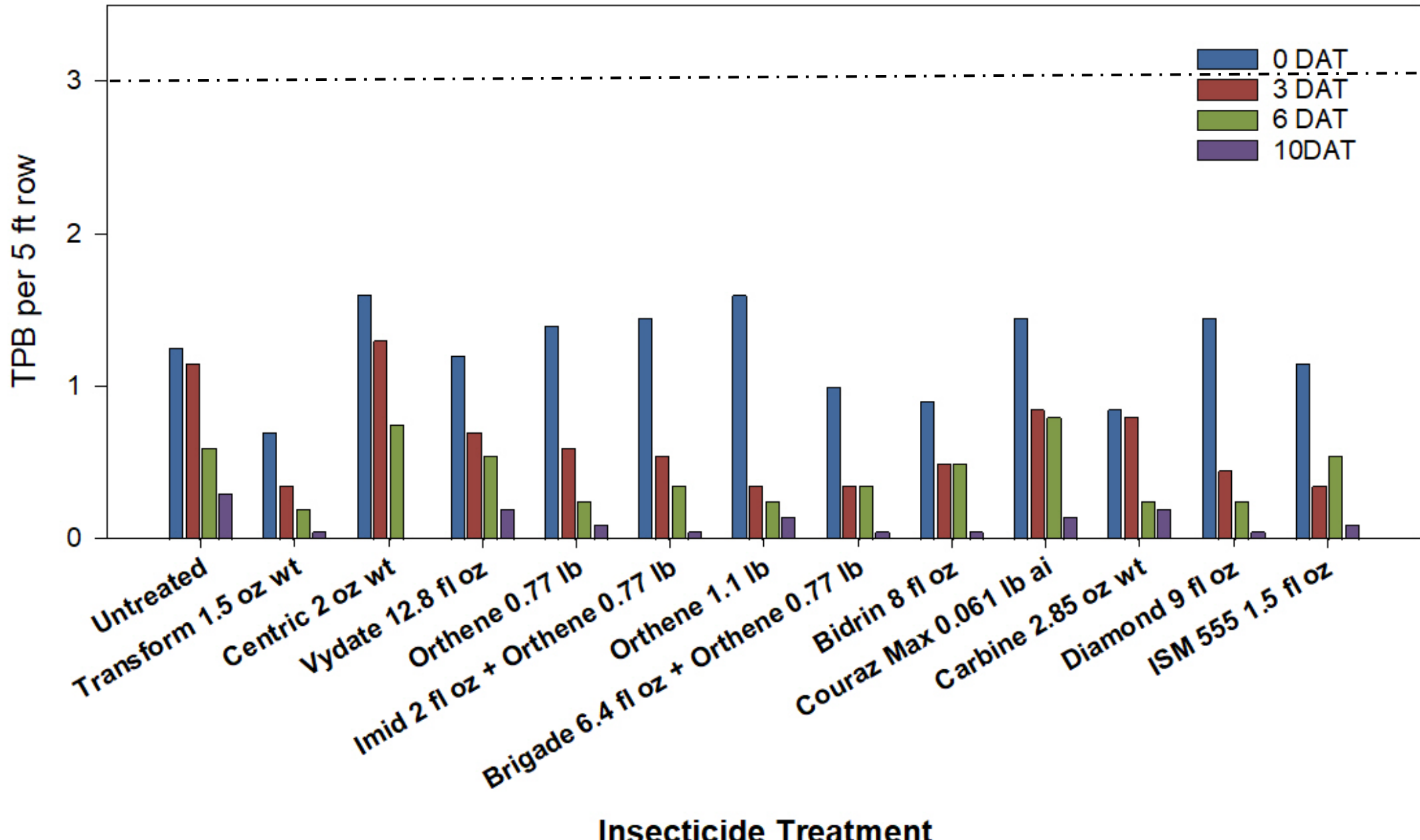


# Field Trials with TPB

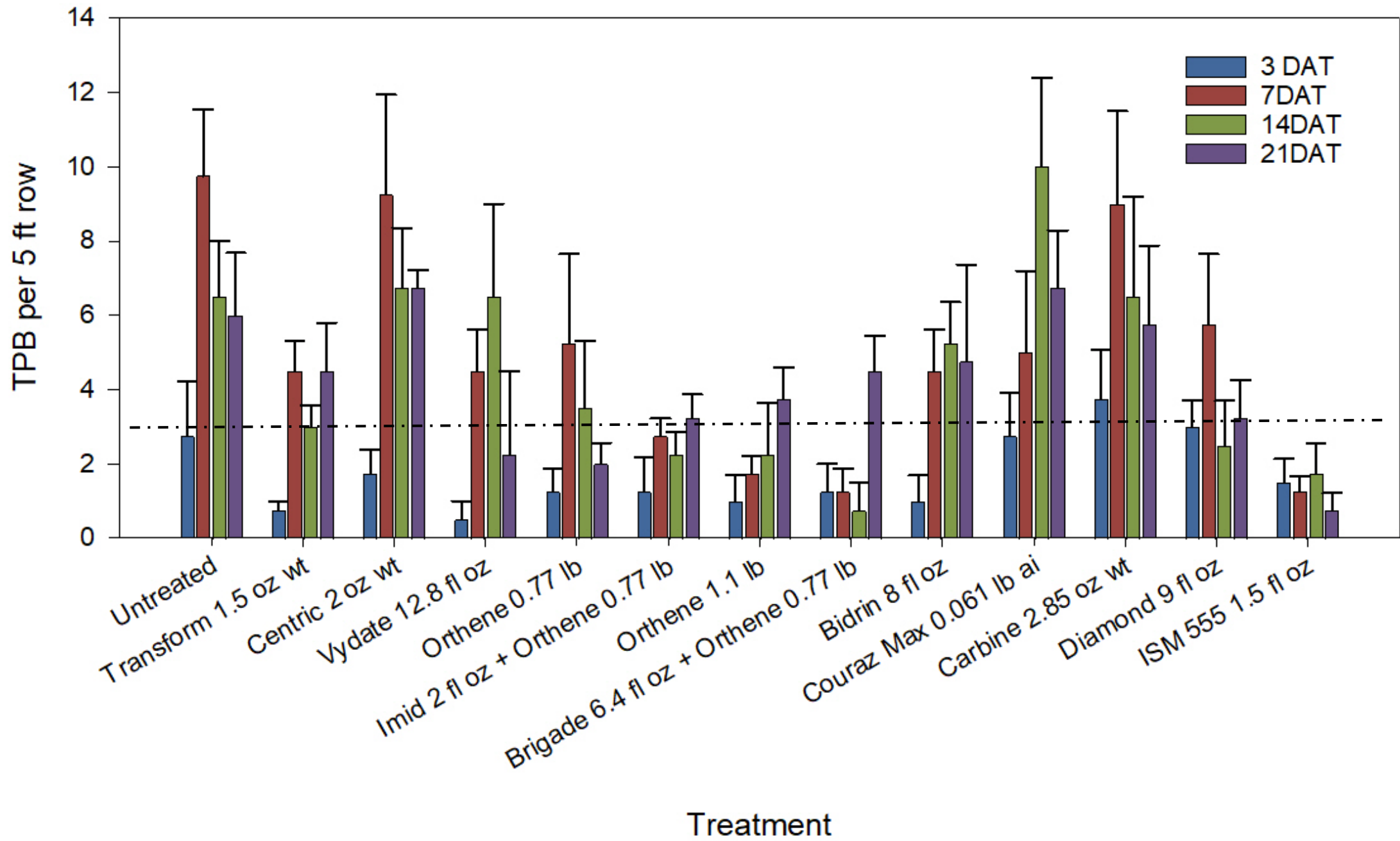
# MRRS 2022

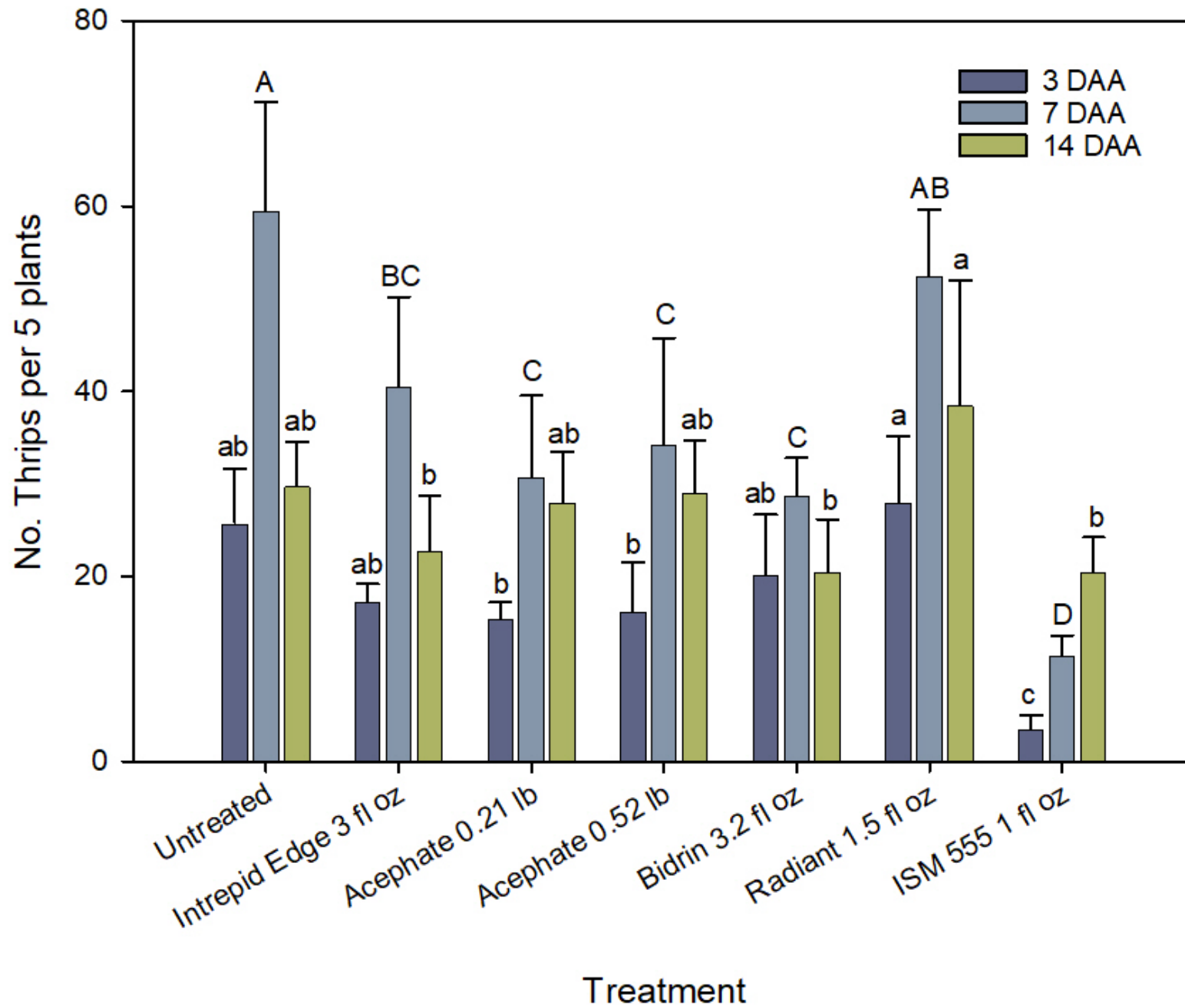


# MRRS 2023



# DLREC 2023





# DLREC Foliar Thrips Trial 2023

# Considerations

- Broad-spectrum (effective against spider mites, stink bugs, etc.)
- Price???

## 2024 Field Research

-Efficacy

-Timing

-System approach (rotate with other insecticides)

-ThryvOn and Plinazolin

