

NOVEL INSECTICIDES

1. Neonicotinoids- Similar to **nicotines** in activity and structure

- Interact with **acetyl choline binding site of nicotinic Ach receptor**
- cause **excitation and eventually paralysis**
- **selective** and **safe** to non target organisms

1) Imidacloprid: Systemic with **translaminar activity**

- Used as a **seed dressing, soil application and foliar application**
- against **sucking insects** including leaf hoppers, plant hoppers, aphids, thrips and whitefly
- It is **highly toxic to birds**

Trade names: **Confidor, Gaucho**, Admire, Tatamida

2) Acetamiprid: Trade names: **Pride**, Profil, Supreme

3) Thiomethoxam : very strong effect on **viral transmitting insects**

Trade names: **Actara**, Cruiser, Crux

Phenyl pyrazoles (Fiproles):

1) Fipronil

- **GABA receptors** is the target site for fipronil
- Blockage of **GABA gated chloride channel** reduces neuronal inhibition
- Leads to **hyper excitation** of the central nervous system, convulsions and death of an target pest
- Used as a foliar application against stem borer, leaf miner, hoppers, root worm and mites

Trade names: **Regent**, Front line

Macrocyclic lactones

1. **Spinosyns – Spinosad**- primary components are spinosyn A and spinosyn D

- The extract of the fermentation broth produced by the microorganism, **Saccharopolyspora spinosa**
- kills insects by causing **rapid excitation** by activation of nicotinic acetylcholine receptors
- leads to involuntary muscle contractions, prostration with tremors, and paralysis
- contact and stomach poison with some **translaminar movement** in leaf tissue
- Trade names: **Tracer, Spintor**, Precise, Success

2. Avermectins- produced by the soil microorganism *Streptomyces avermitilis*

- having nematicidal, miticidal and insecticidal activity
- **activate the GABA gated chloride channel**, causing **an inhibitory effect** results in the insect's death
- **Contact and stomach poisons**
- Used as bait, foliar application against Homoptera, Diptera, Coleoptera, Lepidoptera and mites

Emamectin benzoate: by **translaminar** movement and effective against Lepidopterans Trade names: Proclaim

Abamectin: acting on mites of **Tetranychidae, Eriophyidae and Tarsonemidae**

- also effective against **Lepidopterans**
- Trade names: Avid, Agrimec, Vertimec, Argi-mek, Affirm and Avert

3. Oxadiazines

- Indoxacarb: a stomach poison with slight contact action Trade names: **Avaunt**, Steward
- Absorbed or ingested, **feeding cessation** occurs almost immediately
- kills by binding to a site on **sodium channels and blocking the flow of sodium ions** into nerve cells
- impaired nerve function, feeding cessation, paralysis, and death

4. Thio-Urea Derivatives- Diafenthiuron is new types of thiourea derivative Trade names: **Polo**

- acts specially on **sucking pests** such as mites, whiteflies and aphids
- **photochemically** converted within a few hours in sunlight to its **carbodiimide** derivative
- **Inhibitor of oxidative phosphorylation**, via disruption of ATP formation (inhibitor of ATP synthase)
- It acts as **Acaricide** cum-insecticide as a foliar sprays against mites, sucking pests, lepidopteran insect pests

5. Pyridine Azomethines

- **Pymetrozine**- highly active and specific against **sucking insect pests** Trade names: **Full fill, Chess**
- has **high degree of selectivity**
- When the stylets are inserted into the **pymetrozine treated tissues**, stylets are almost immediately **blocked**
- The sucking insects die by starvation a few days later (**feeding depressant**)

6. Pyrroles- oxidative phosphorylation inhibitors

- It works by uncoupling **oxidative phosphorylation from electron transport process** in mitochondria
- Interferes with **formation of ATP** which is essential for muscle contraction

1. **Chlorfenapyr**: It is a miticide and insecticide Trade names: **Pirate ,Pylon**

- Has broad spectrum activity against many species of Coleoptera, Lepidoptera, Acarina and Thysanoptera
- Mainly stomach poison and has contact action also

7. Formamidines

- actions for the control of phytophagous mites, ticks and certain insects (Lepidoptera and Hemiptera)
- act as agonists of **octapamine receptors**
- octapamine act as neurotransmitter, neuromodulator and is involved in energy metabolism and stress responses

1. **Chlordimeform:** translaminar and systemic activity Trade names: **Galecron**, Fundal, Fundal, Spike

- shows a **strong repellent-antifeedant action** on both lepidopterous larvae and mites

2. **Amitraz:** non systemic insecticide and acaricide with contact and respiratory action Trade names: **Acarac**, **Amitraz**

- used to control **red spider mites**, leaf miners, scale insects, and aphids

8. Ketoenols- act as insecticide and acaricides against all developmental stages

- tetrone acid insecticides with acaricidal action
- **inhibit lipogenesis** in treated insects, resulting in decreased lipid contents
- **growth inhibition** of younger insects, and **reduced ability of adult insects to reproduce**

1. Spiromesifen: particularly active against **juvenile stages** Trade names: **Oberon, Forbid**

- However, it also strongly **affects fecundity** of mite and whitefly adults

2. Spirodiclofen: selective, non-systemic foliar insecticide and acaricide Trade names: **Envidor**

- Effective against mites and sanjose scales

3. Spirotetramat: effective against sucking insects mites on crops like citrus, vegetables Trade names: **Movento, Ultor**

9. Diamides

1. Chlorantraniliprole Trade names: **Coragen 200SC and Altacor 35 WG**

- Efficacious for control of orders lepidoptera, Coleoptera, Diptera and Hemiptera
- Exhibits **larvicidal activity** as an orally ingested toxicant by targeting and **disrupting the Ca²⁺ balance**
- Activates ryanodine receptors via stimulation of the release of calcium stores from the sarcoplasmic reticulum of muscle
- cells (i.e for chewing insect pests) causing impaired regulation, paralysis and ultimately death of sensitive species

2. Cyantraniliprole- efficacious against a **cross spectrum of chewing and sucking pests**

- Targets and **disrupts Ca²⁺ balance in nervous system** Trade name : **Cyazypyr**

3. **Flubendiamide**: lepidopteran insecticide Trade names: **Fame, Belt**

- Acts by ingestion and disrupts Ca²⁺ balance in the nervous system
- Rapid cessation of feeding and extended residual control

IGRs

Chitin synthesis inhibitors - disrupt molting by **blocking the formation of chitin**

Molting is incomplete, resulting in malformed insects that soon die

Suppresses egg-laying and causes **egg sterility** in treated adults through **secondary hormonal activity**

Eg. Diflubenzuron: Dimilin

Buprofezin: Applaud

Juvenile Hormone (JH) Mimics- compounds showing JH activity, **'Juvenoids'**

First recognized by Williams (1965)

- Four types of JHs (JH= 0, I, II, and III)
- Said to be morphogenetic in action i.e to **retain the larval characters**
- **'Paper factor'**- (Karel Slama & C.M. Williams , 1966) against the bug **Pyrrhocoris apterus (Heteroptera)** was subsequently traced to be balsam fir trees, **Abies balsamea** from the wood pulp, scientifically named **'Juvabione'**
- **Mode of Action:**

i) Antimorphic effect: force larva to continue as a larva

The larvae will undergo an extra larval moult (**super larva**) or moult in to **defective intermediate forms**

ii) Larvicidal effect iii) Ovicidal effect iv) Diapause disrupting effect v) Embryogenesis inhibiting effect

- i) Juvabione (Fernesol - extracted from excreta of Tenebrio sp)
- ii) Methoprene (Altosid)
- iii) Hydroprene (Gentrol, Altozar)
- iv) Kinoprene (Enstar)

- **Anti JH or JH Agonists or Precocenes:** found in plants that induce reversible precocious metamorphosis
 - Suppress the function of the **corpora allata gland**
 - Antagonize the JH activity and **disarrange the insect development**
 - Induce the **precocious metamorphosis** of immature insects
 - Affect **insect diapause, reproduction and behavior**
 - First extracted from the plant **Ageratum houstonium** contains two simple **chromene** compounds **precocene –I and II**
- 1) Fenoxycarb (Insegar 50 % 2) Pyriproxyfen (Tiger 10 % EC)

Ecdysone or Moulting Hormone (MH) Agonists- contains two hormones, α -Ecdysone and β – Ecdysone

- Synthetic analogues of ecdysones are called **ecdysoids**
 - Binds to the **ecdysone receptor proteins** which initiates moulting process
 - The normal moulting process is disrupted
 - Larvae is **prevented from shedding of old cuticle** and it will die due to dehydration and starvation
- a) Tebufenozide (Mimic, Confirm and Romdan)
 b) Halofenozide (Mach)
 c) Methoxyfenozide (Prodigy)