K.T.S.P.Mandal's

Hutatma Rajgurunagar Mahavidyalaya

Rajgurunagar 410 505

Department of Zoology

SPPU T.Y.B.Sc (Zoology)

(CBCS 2021-22)

ZO- 351 PEST MANAGEMENT

By

Prof. Dr. Theurkar S.V.

CHAPTER VII INSECTICIDES

Insecticides are substances used to kill insects. They include ovicides and larvicides used against insect eggs and larvae, respectively. Insecticides are used in agriculture, medicine, industry and by consumers. Insecticides are claimed to be a major factor behind the increase in the 20th-century's agricultural productivity. Nearly all insecticides have the potential to significantly alter ecosystems; many are toxic to humans and/or animals; some become concentrated as they spread along the food chain.

7.1. CLASSIFICATION OF INSECTICIDES BASED ON MODE OF ENTRY

- Insecticides can be classified into two major groups: systemic insecticides, which have residual or long term activity; and contact insecticides, which have no residual activity.
- The mode of action describes how the pesticide kills or inactivates a pest. It provides another way of classifying insecticides. Mode of action can be important in understanding whether an insecticide will be toxic to unrelated species, such as fish, birds and mammals.
- Insecticides may be repellent or non-repellent. Social insects such as ants cannot detect non-repellents and readily crawl through them. As they return to the nest they take insecticide with them and transfer it to their nestmates. Over time, this eliminates all of the ants including the queen. This is slower than some other methods, but usually completely eradicates the ant colony.
- Insecticides are distinct from non-insecticidal repellents, which repel but do not kill.

7.2. ACTION AND CHEMICAL NATURE

Insecticides can be classified in any of several ways, on the basis of their chemistry, their toxicological action, or their mode of penetration.

In the latter scheme, they are classified according to whether they take effect upon ingestion (stomach poisons), inhalation (fumigants), or upon penetration of the body covering (contact poisons).

- Most synthetic insecticides penetrate by all three of these pathways, however, and hence are better distinguished from each other by their basic chemistry.
- Besides the synthetics, some organic compounds occurring naturally in plants are useful insecticides, as are some inorganic compounds; some of these are permitted in organic farming applications.
- Most insecticides are sprayed or dusted onto plants and other surfaces traversed or fed upon by insects.

Systemic insecticides

- Systemic insecticides become incorporated and distributed systemically throughout the whole plant. When insects feed on the plant, they ingest the insecticide. Systemic insecticides produced by transgenic plants are called plant-incorporated protectants (PIPs).
- For instance, a gene that codes for a specific *Bacillus thuringiensis* biocidal protein was introduced into corn (maize) and other species. The plant manufactures the protein, which kills the insect when consumed.

Contact insecticides

- Contact insecticides are toxic to insects upon direct contact. These can be inorganic insecticides, which are metals and include the commonly used sulfur, and the less commonly used arsenates, copper and fluorine compounds.

- Contact insecticides can also be organic insecticides, i.e. organic chemical compounds, synthetically produced, and comprising the largest numbers of pesticides used today.
- Or they can be natural compounds like pyrethrum, neem oil etc. Contact insecticides usually have no residual activity.
- Efficacy can be related to the quality of pesticide application, with small droplets, such as aerosols often improving performance.

7.3. INSECTICIDES FORMULATIONS AND THEIR USES

A Insecticide or pesticide formulation is a mixture of chemicals which effectively controls a pest. Formulating a pesticide involves processing it to improve its storage, handling, safety, application, or effectiveness.

A	**Aerosol**
B	**Bait**
D	**Dust**
DF	**Dry flowable**
E,EC	**Emulsifiable concentrate**
FL	**Flowable**
G	**Granule**
M	**Microencapsulated**
P	**Pellet**
RTU	**Ready-to-use**
SP	**Soluble powder**
ULV	**Ultra-low-volume concentrate**
WP	**Wettable powder**
WDG	**Water-dispersible granule**

7.4. SAFE HANDLING OF INSECTICIDES

Pesticides are vital to the agricultural industry for the production of food and fiber, and are quite effective when used appropriately. However, you must be very careful about how you handle these chemicals, as well as how you transport, store, mix, load, apply and dispose of them.

Store pesticides properly

Not only is it important, but it is also legally required that pesticides are stored in a safe, secure and well- identified place.

- Pesticides should be stored in a properly labeled container with the label clearly visible. Never store pesticides in old bottles or food containers where they could be mistaken for food or drink for people or animals.
- You must never store pesticides near food, feed or seed.
- Store pesticides in containers that can be tightly sealed. Check the containers regularly to make sure they have no leaks, breaks, tears or defects.
- Store pesticides in a location away from freezing temperatures or extreme heat.
- All pesticides are to be stored under lock and key at all times. The building, room or structure where they are stored should be clearly marked with pesticide warning signs.

MIX AND LOAD PESTICIDES PROPERLY

Many injuries occur when chemicals are being mixed. The most dangerous pesticide job is pouring and mixing the concentrated chemicals.

- Before you begin to mix the chemical, READ THE LABEL.

- Before handling a pesticide, put on protective clothing (coveralls, gloves, boots, goggles or face shield, hat, and respirator if the label indicates one must be worn.)
- Mix the pesticides outdoors where there is good ventilation and light.
- Stand upwind of the pesticide to avoid contaminating yourself.
- Use a specifically designated sharp knife to open pesticide bags. Do not use scissors or a personal knife; do not tear bags open.
- Measure accurately and use only the amount specified on the label. It's against the law to use more than label directions indicate.
- When removing concentrated material from the container, keep the container below eye level to avoid splashing or spilling the pesticide into your face and eyes.
- If you splash or spill a pesticide, STOP IMMEDIATELY! Remove your contaminated clothing and wash it thoroughly with soap and water. Speed is essential when you or your clothing are contaminated. Remember also to clean up the spill.
- California safety regulations require that closed systems be used when you mix more than 1 gallon of liquid category 1 pesticides per day. Category 1 pesticides are any that have the word DANGER on the label.

APPLY PESTICIDES PROPERLY

Careful attention to simple guidelines during pesticide mixing and application will greatly increase your ability to control the pest and will make your job much safer for you and those around you. (See Figure 3.)

- Before you begin to apply a pesticide, READ THE LABEL and put on the required protective clothing.
- Check the equipment for leaking hoses or connections and plugged or worn nozzles, and examine the filter to see that it's clean and free of debris.
- Clear all livestock, pets and people from the area to be treated and calibrate your equipment before you begin to use it to ensure the proper amount is coming out.
- Mix the pesticide at the recommended rate and apply it at the specified dosage. Make sure the measurement device you use is a proper, commercially designed device for applying pesticides. Do not guess at the measurement. Apply pesticides only at the correct time and under favorable weather conditions. Never apply a pesticide if the wind will cause the pesticide to drift out of the area to be treated.
- Use extreme care to prevent the pesticide from contaminating streams, ponds, lakes or other bodies of water.
- As with any safe handling training, it is important to know what you can do to prevent becoming exposed to a toxic substance. Outlined below are pointers about pesticide exposure.

DON'T EAT, DRINK OR SMOKE AROUND PESTICIDES

Do not carry cigarettes in your pockets, nor eat or drink while working with pesticides. Your cigarettes can absorb pesticide film or residue that could make you sick. Also, be careful not to wipe your face with your shirt sleeves. This could put the pesticide directly onto your bare skin.

AVOID PESTICIDE EXPOSURE

There are four ways that pesticides can enter the body: through the skin, the mouth, the nose and the eyes. Pesticides can enter your body in solid, liquid or gaseous form.

It's particularly important to remember that highly concentrated and highly toxic chemicals, especially liquids and gases, present the greatest danger. If they are not washed off immediately, the liquid concentrates can penetrate your unbroken skin.

- The longer a pesticide remains on your skin or in your eyes, or the longer you inhale it, the greater the damage that is likely to occur.
- Protective clothing, such as coveralls, aprons, boots, gloves, goggles and face shields, and respirators provide protection against exposure to these chemicals.
- Absorption through the skin is the most common form of poisoning. Absorption may occur from a splash, spill or drift when mixing, loading, applying, or disposing of pesticides. It may also result from exposure to large amounts of residue while cleaning out clogged nozzles and filter screens. Generally, wettable powders, dusts and granular pesticides are not as easily absorbed thorough the skin and other body tissues as are the liquid forms. Again, consistent use of proper protective clothing will greatly reduce the potential risk of pesticide absorption.

If a pesticide is taken into the mouth in sufficient amounts, it may cause serious illness, severe injury, or even death. The most frequent cases of accidental oral exposure are those when pesticides have been taken out of

their original labeled container and illegally put into an unlabeled bottle or food container.

- For this reason, always store a pesticide in a properly labeled container. If you get a clogged spray line or nozzle, never use your mouth to clear it. And never eat or smoke until you have left the spray area and have washed off thoroughly with soap and water.

Pesticides that are inhaled in large enough amounts can cause serious damage to nose, throat, and lung tissues. Vapors and extremely fine particles are the most serious contributors to respiratory exposure. Wear your respirator while working with powder and liquid pesticides. If you are unsure if a respirator is needed, ask your supervisor.

Reference Books -

1. Handbook of Pest Management in Agriculture by Pimentel.

2. Principles of Insect Pest Management by Dhaliewal and Arora.

3. Agricultural Pest of India & South East Asia by A. Satwal.

4. Pathological Problems of Economics Crop Plants & their Management by Paul Khurana, S. M., 1998.

5. Integrated Diseases Management and Plant Health by Gupta V. K. & Sharma R. C.

6. Diseases of Millets by Ramkrishnan T. S., I. C. A. R. Publ. New Delhi.

7. Fungal diseases of Rice in India by Padmanabhan S. Y., I. C. A. R. Publ., New Delhi.

8. Analysis of Pesticides Residues by H. A. Moye (JW)

9. Advance in Pest Control Research by R. L. Methcalf (JW)

10. Chemistry of pesticides by K. H. Buchel (JW).

11. Progress in Pesticides Biochemistry and Toxicology Vol. I, II & III by D. H. Hutsonand T. R. Robert.

12. Evaluation of Pesticides in Ground Water by W. Y. Garnett, R. C. Honeycatt and others.

13. Chemistry of Pesticides by Edward

14. Insecticide Biochemistry and Physiology by C. F. Wilkinson.