



IIT KHARAGPUR



NPTEL ONLINE
CERTIFICATION COURSES

Organic Farming for Sustainable Agricultural Production

Dr. Dillip Kumar Swain, Associate Professor

Agricultural and Food Engineering Department

Lecture 20 : Level “C” Pest and Disease Management (Contd..)

Action of Neem oil

Mode of action

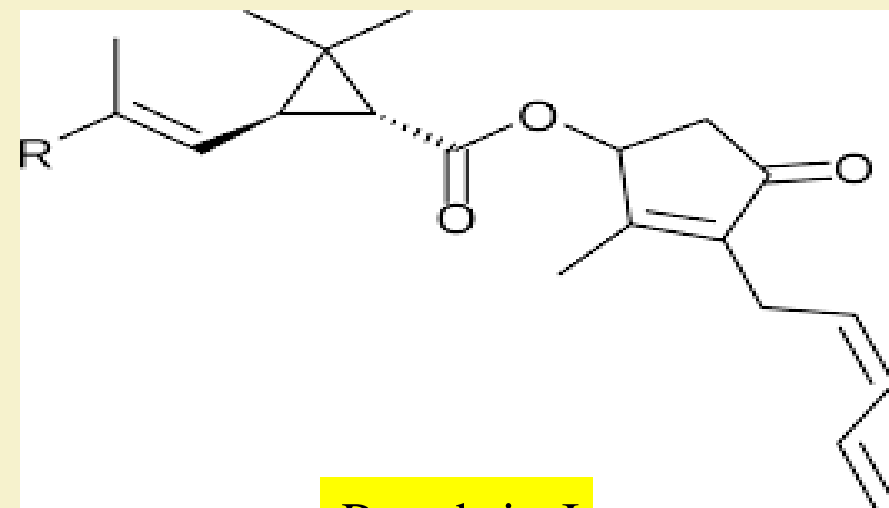
- **Disrupting or inhibiting** the development of eggs, larvae, or pupae
- **Blocking the molting** of larvae or nymphs
- **Disrupting** mating and sexual communication
- **Repelling** larvae and adults
- **Deterring** females from laying eggs and feeding
- **Sterilizing** adults
- **Poisoning** larvae and adults
- **Inhibiting** the formation of chitin

Neem formulation:

Ground 30 g neem kernels (that is the seed of which the seed coat has been removed) and mix it in 1 litre of water. Leave that overnight. The next morning, filter the solution through a fine cloth and still with little soap powder and spray in afternoon.

Pyrethrum and Pyrethrins

- Pyrethrum is a daisy-like **Chrysanthemum**.
- Pyrethrins are insecticidal chemicals extracted from the **dried pyrethrum flower**.
- The flower heads are processed into a powder to make a dust. This dust can be used directly or infused into water to make a spray.
- **Pyrethrins** cause immediate paralysis to most insects.
- Low doses do not kill but have a “knock down” effect stronger doses kill.
- Pyrethrins break down very quickly in sunlight so they should be stored in darkness.



Pyrethrin-I



Tanacetum cinerariifolium

Mode of action of Pyrethrum

- ✓ Pyrethrins exert their toxic effects by disrupting the **sodium and potassium ion exchange** process in **insect nerve fibers** and interrupting the normal transmission of **nerve impulses**.
- ✓ Pyrethrins insecticides are extremely fast acting and cause an immediate **“knockdown” paralysis in insects**.
- ✓ Despite their rapid toxic action, however, many insects are able to **metabolize (break down) pyrethrins** quickly. **After a brief period of paralysis, these insects may recover rather than die.**
- ✓ **To prevent insects from metabolizing pyrethrins and recovering from poisoning, most products containing pyrethrins also contain the synergist, piperonyl butoxide (PBO).** Without PBO the effectiveness of pyrethrins is greatly reduced.

Pyrethrin Formulations

- ❖ Pyrethrum powder is made with dried ground flowers.
- ❖ To make liquid pyrethrum extract (mix 20g pyrethrum powder with 10 l water), add soap to make the substance more effective. Strain and apply immediately as a spray.
- ❖ For best effects this should be applied in the evening. Pyrethrum can also be extracted by alcohol.



1. Obtain the flower heads.



2. Mix the flower heads with the hot water.
Allow to stand for one hour.



3. Strain off the flower heads.



4. Add the soap powder and mix.



5. Pour the mixture into a spray bottle



6. Spray

Rotenone

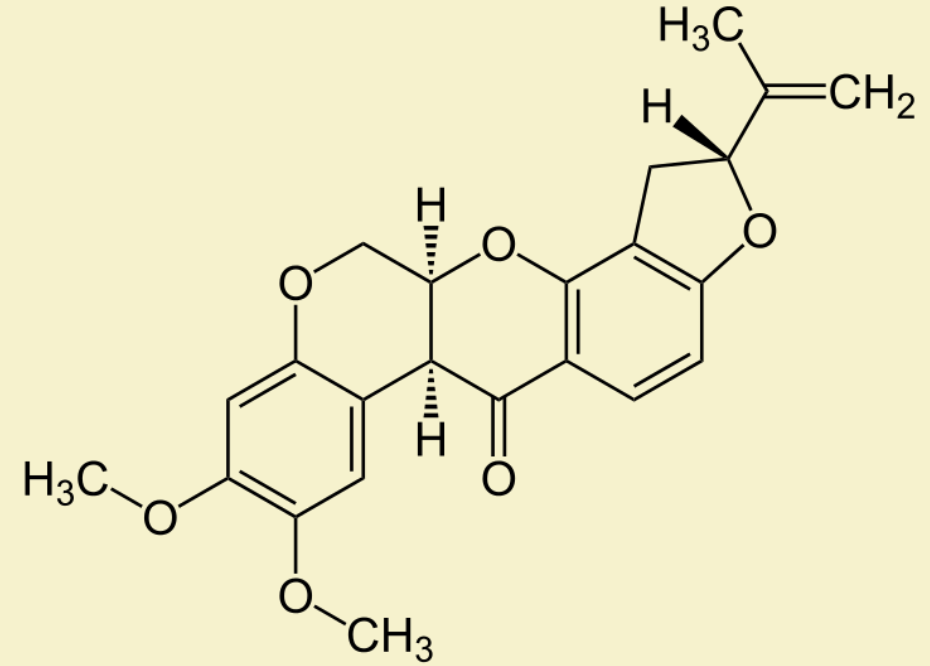
✓ **Rotenone** is insecticidal compound that occurs in the **roots** of Derris species in Asia, and several other related **tropical legumes**.

✓ Currently the main commercial source of rotenone is **Peruvian *Lonchocarpus***, which often is referred to as cube root.

✓ Rotenone is extracted from cube roots in acetone or ether.

✓ Most rotenone products are made from the complex resin rather than from purified rotenone itself.

✓ Alternatively, **cube roots may be dried**, powdered and mixed directly with an inert carrier to form an insecticidal dust.



ROTENONE

Mode of action of Rotenone

- Rotenone is a powerful inhibitor of cellular respiration, the process **that converts nutrient compounds into energy** at the cellular level.
- In insects rotenone exerts **its toxic effects primarily on nerve and muscle cells**, causing rapid cessation of feeding. Death occurs several hours to a few days after exposure.
- **Rotenone is extremely toxic to fish**, and is often used as a **fish poison (piscicide)** in water management programs.
- Rotenone works by **interfering with the electron transport chain in mitochondria**. It produces oxygen free radical in mitochondria which can **damage the DNA and other components of mitochondria**.

Nicotine

- Nicotine is a simple alkaloid derived from **tobacco**, *Nictiana tabacum*, and other **Nicotiana species**.
- Nicotine constitutes **2-8 % of dried tobacco leaves**.
- Insecticidal formulations generally contain nicotine in the form of **40 % nicotine sulfate**.
- Mostly effective against minute **soft body insects** like **aphids, white flies, fruit tree borers, termites, cabbage butterfly larvae**.



Tobacco plant

Types of Tobacco

Bidi Tobacco

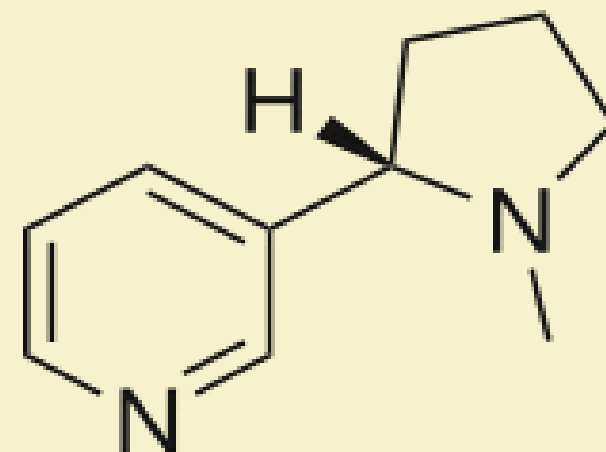
Cigar Tobacco

Chewing tobacco

Hookah tobacco

Mode of action of Nicotine

- In both insects and mammals, nicotine is an extremely **fast-acting nerve toxin**.
- It competes with acetylcholine, the major neurotransmitter, by **bonding to acetylcholine receptors** at nerve synapses and causing **uncontrolled nerve firing**.
- This disruption of normal nerve impulse activity results in rapid failure of those body systems that depend on nervous input for proper functioning.
- In insects, the action of nicotine is fairly selective



Nicotine

Citrus Oil

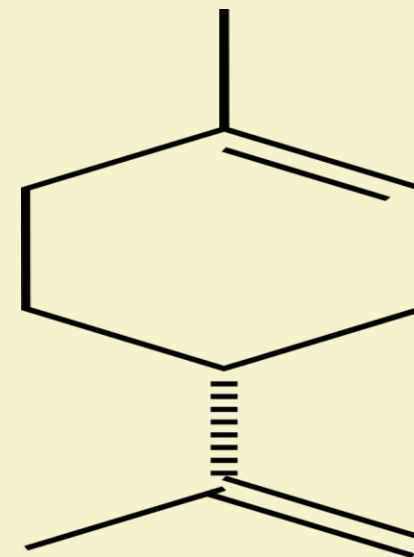
- Crude citrus oils and the refined compounds **limonene** and **linalool** are extracted from orange and other citrus fruit peels.
- Limonene, a terpene, constitutes **about 90 % of crude citrus oil**, and is **purified** from the oil **by steam distillation**.
- Linalool, a terpene alcohol, is found in small quantities in **citrus peel** and in over **200 other herbs, flowers, fruits, and woods**.
- Terpenes and terpene alcohols are among the **major components** of many **plant volatiles or essential oils**.
- Essential oils are the volatile compounds responsible for **most of the tastes and scents of plants**.



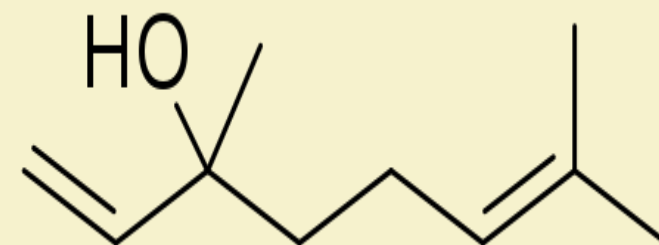
Citrus oil

Mode of action of linalool and limonene

- The modes of action of limonene and linalool in insects are not fully understood.
- Limonene is thought to **cause an increase in the spontaneous activity of sensory nerves**.
- This heightened activity **sends spurious information to motor nerves** and results in **twitching, lack of coordination, and convulsions**.
- The central nervous system may also be affected, resulting in additional **stimulation of motor nerves**. Massive over stimulation of motor nerves leads to **rapid knockdown paralysis**.
- **Adult fleas and other insects** may recover from knockdown, however, unless limonene is synergized by PBO.



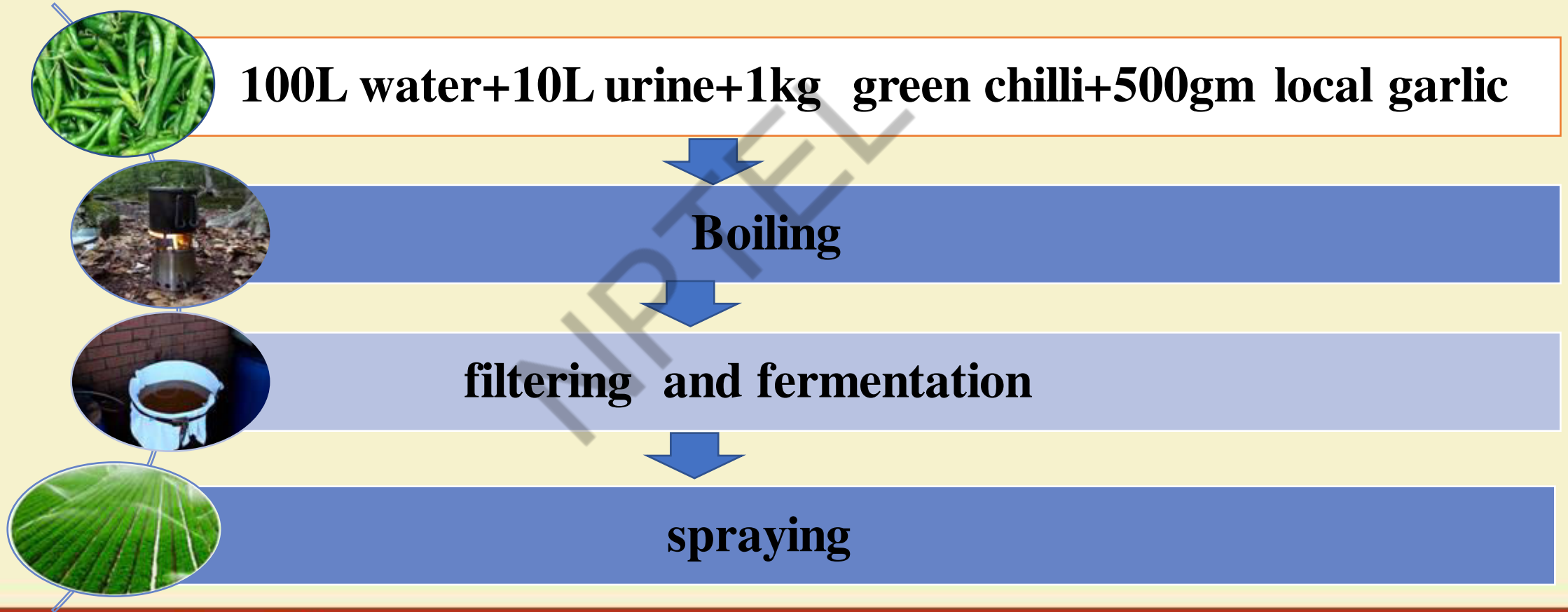
Limonene



Linalool

Plant Protection (green chilli and garlic)

100L water, 10L urine, 1kg green chilli and 500gm local garlic



Plant Protection (Neem and Cow dung and urine)



**100L water+5L urine+5kg neem leaves+5kg
cowdung**



fermentation and filtering



spraying

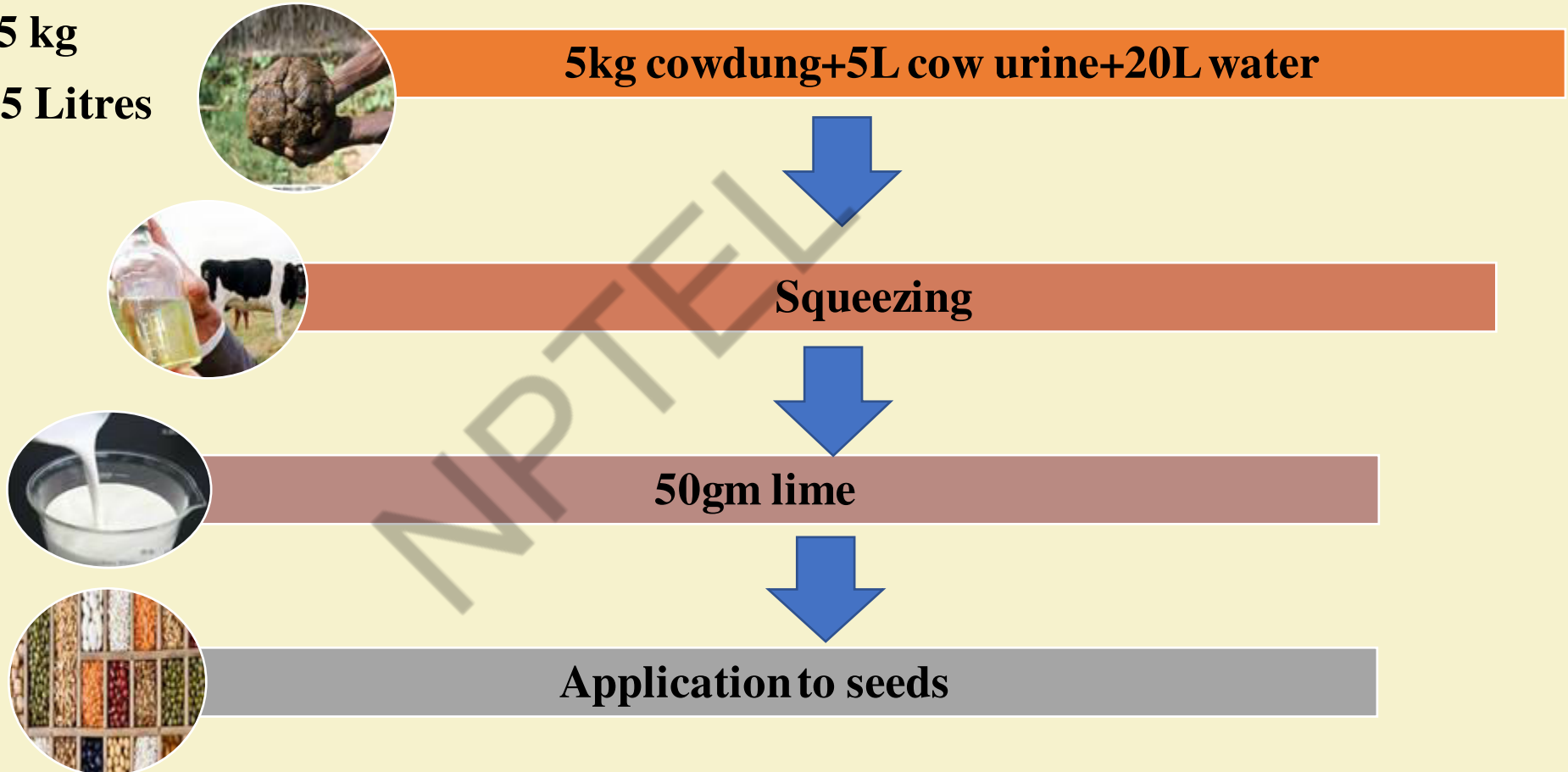
Seed treatment

Water = 20 litres

Desi cow dung = 5 kg

Desi cow urine = 5 Litres

Lime = 50 grams



Soil treatment

- 1) Water 200 litres
- 2) Desi cow dung 10 kg
- 3) Desi cow urine 5 to 10 litres
- 4) Jaggery 2 kg
- 5) Flour of any pulse 2 kg
- 6 Handful of soil from farm or forest



200L water



**10kg coddung+10L cow
urine+2kg jaggery+2kg pulse
flour+ hand full of soil**



Fermentation



Spray with irrigation

Precautions regarding use of plant extracts

- Some botanicals may be dangerous for humans and they can be very toxic to natural enemies. Nicotine for example, derived from the tobacco plant, is one of the most toxic organic poisons for humans and other warm-blooded animals. Pyrethrins are not poisonous for humans and warm-blooded animals
- Before a new botanical pesticide is applied in a large scale, its effect on the ecosystem should be tested in a small field experiment. **Do not just use botanical pesticides as a default option!**
- Do not have direct skin contact with the crude extract during the process of preparation and application.
- Contact with plant extracts should be avoided in the eyes.
- Make sure that you place the plant extract out of reach of children during storage.
- Wear protective clothing (eyes, mouth, nose and skin) while applying the extract.
- Wash your hands after handling the plant extract.