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COMPREHENSIVE DISINFECTION STRATEGIES FOR EFFECTIVE SILKWORM DISEASE MANAGEMENT AND ENHANCED SILK PRODUCTION

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Silkworm disease management is critical for maintaining healthy colonies and ensuring silk production. Disinfection plays a vital role in controlling pathogens within the rearing environment. Both physical and chemical methods, including sunlight, ultraviolet radiation, heat and various chemical disinfectants such as formalin, slaked lime and bleaching powder, are used to destroy pathogens. Effective disinfection requires careful selection of methods based on factors such as safety, surface types and microbial load. Regular application of bed disinfectants, like slaked lime, prevents disease spread. A well-planned disinfection schedule ensures the control of diseases, leading to better silkworm health and higher yields.

Mulberry silkworm, *Bombyx mori*, the primary producer of commercial silk is domesticated for many centuries. The colonization has rendered the silkworms to lose its natural abilities to withstand the adverse climatic conditions and pathogen infection. The breed improvement programmes aimed at evolving breeds with certain economic parameters have further eroded their ability to withstand pathogenic infections. This has made them susceptible to many diseases, causing crop loss or low yield, which ultimately has led to low silk production.

This shows that epizootic condition in the colonies has forced a need for disinfection in silkworm rearing. Disinfection is one of the strategic activities in the management of silkworm to reduce the chances of disease-causing pathogen in the environment. The chemical disinfectants are being sprayed before the rearing process starts, while bed disinfectants are being dusted during the rearing period of silkworms.

Disinfection: Disinfection means the destruction of pathogens.

Certain factors are to be considered, while selecting a disinfection method for the rearing room and appliances.

- a. The method should be effective.
- b. The method should be simple and easy for application.
- c. The method should be harmless to humans and domestic animals.
- d. The method should be harmless to building and equipment's.
- e. The method should not be corrosive to the building or equipment's.

1. Physical Methods:

- **Sunlight:** Sunlight acts as a disinfectant due to the heat it generates on the surface to be disinfected as well as due to the ultraviolet radiation emitted. Many pathogens lose its infectivity when the contaminated rearing trays are exposed to hot sun for 20-30 h.
- **Ultraviolet radiation:** Ultraviolet radiation of approximately 257 nm wavelength emitted by ultraviolet lamps is germicidal and can be used effectively to eliminate pathogenic microorganisms on the exposed surfaces and in air. The UV radiation disrupts DNA and RNA in living organisms.
- **Flame or fire:** Oxidizes the microorganism into ashes.
- **Heat:** It is an effective destroyer of pathogens. Dry heat destroys the microorganisms by oxidation and is non-corrosive and less effective than moist heat.
- **Boiling water:** Use of boiling water is an effective disinfection method. The maximum temperature obtainable is 100°C and the exposure of 10-30 min, is effective.

2. Chemical methods: Chemical control can be exercised more effectively by carrying out the disinfection process by chemical disinfectants. Chemical means of disinfection uses specific chemicals that have the germicidal activity against the desired microbes to ensure and accomplish effective disinfection. An ideal disinfectant should not pose health hazard, should not cause skin irritation, should be nontoxic and should not emit foul smell. Selecting a chemical disinfectant is however determined by several factors.

1. Number and nature of microbes to be destroyed.

2. Type of surface of rearing house and appliances.
3. Interaction with organic matter present in the surface to be disinfected.
4. Contact time and temperature conditions.
5. Toxicity to individuals, residual toxicity and effect on items such as fabric and metal.
6. pH, temperature, hardness of water being used.
7. Cost.

Some of the disinfectants being used in silkworm rearing environment are

1. **Formalin:** Formaldehyde in water is formalin and is known as formic aldehyde, methyl aldehyde, ethylene oxide, oxomethane and oxymethylene. It is a colourless gas and usually available as a 36% solution in water and methanol.
2. **Chlorinated lime:** Commonly known as bleaching powder is a mixture of calcium hypochlorite, basic chloride, calcium hydroxide and free slaked lime. The active ingredient is hypochlorite. It is a white amorphous powder with a pungent smell of chlorine.
3. **Chlorine dioxide:** Chlorine dioxide as gas is well known as most powerful and anti-microbial agent and its advantage as a hard surface disinfectant is widely recognised. Chlorine dioxide is a yellow to green coloured gas with a distinct odour similar to that of chlorine. Chlorine dioxide gas is highly toxic and vary unstable.
4. **Calcium hydroxide (Slaked lime):** It is an antiviral agent and commonly used as a silkworm body and rearing seat disinfectant.
5. **Asthra:** Asthra is a commercial product available in the market. 0.05% solution of Asthra is effective against all pathogens, causing diseases in silkworms.

Estimate Required Quantum of Disinfectant Solution

To calculate the quantity of disinfectant for a rearing house, the area and height should be determined. Measure the length (L), Breadth (W) and height (H) of the rearing house with the help of a measuring tape. Calculate the floor area of the rearing house by multiplying length \times breadth of rearing house. That is, Floor area = Floor length \times Floor breadth.

For example: Area of a rearing house with length 15 meters and width 10 meters = 15 meters \times 10 meters = 150 sq. meters.

Estimation of the requirement of disinfectant is done by multiplying the floor area in Sq. meter with 1.5 litres. Add 500 ml for every addition of 1-meter height of the rearing house beyond 3 meters. Add 10% extra to estimated quantity of disinfectant for shoot rearing. Add 35% extra to the estimated quantity of disinfectant for tray rearing.

Schedule of disinfection activities: The effective disinfection is achieved by following the recommended disinfection schedule.

1. Collect the left out mulberry and other bed refuse immediately after marketing of cocoons and put them into compost pit.
2. Collect diseased and dead larvae/pupae/floss etc., and disinfect by sprinkling 5% bleaching powder in slaked lime powder and dispose suitably.
3. Burn the floss on the mountages using flame gun.
4. Conduct first disinfection with any recommended disinfectant using power sprayer.
5. 5 days before brushing, clean the rearing house and appliances and wash in water. Dry the appliances in bright sunlight for a minimum period of 10-12 hrs.
6. 4 days before brushing, continue the sun drying of the appliances. If the prevalence of viral diseases were high during the previous crop, disinfect the rearing house and appliances with 0.3% slaked lime solution.
7. 3 days before brushing, conduct second disinfection of rearing house with suitable chemical disinfectant.
8. 2 days before brushing, dust 5% bleaching powder in slaked lime powder @ 200g/sq. m. at the passage and rearing house surroundings.
9. 1 day before brushing, arrange appliances for rearing.

Preparation of Different Disinfectant Solutions

1. **Preparation of 2% formalin solution:** To prepare a known volume of 2% Formalin solution, divide the total quantity of the solution required by 18 to get the quantity of formalin required. To this formalin, add water, 17 times to make 2% formalin solution. Or alternatively, to one part of formalin add 17 parts of water.
2. **Preparation of 2% bleaching powder in 0.3% slaked lime solution:** For preparing 100 litres of 2% bleaching powder solution in 0.3% slaked lime solution, add little water to 2 kg of bleaching powder and 0.3 kg of slaked lime

and make a paste. Add this paste to the rest of water and stir it well. Keep for 10 minutes and use the supernatant for disinfection.

3. Preparation of 2.5% chlorine di oxide solution in 0.5% slaked lime solution:

For preparing 2.5% chlorine dioxide solution, use the commercially available Sanitech or Serichlor solutions. Use 50 g of activator of every 500 ml of solution. For preparing 100 litres of chlorine di oxide solution, take 250 g activator crystals into a basin/bucket and add 2.5 litres of Sanitech or Serichlor solution. Stir and keep for 10 min. Add activated solution to 97.5 litres of water and add 500 g of slaked lime. Mix thoroughly and use for disinfection.

4. Preparation of 0.05% Asthra solution: For disinfection of rearing house, its surroundings and appliances, 0.05% Asthra solution is recommended. To prepare 0.05% Asthra solution, Add 50 g Asthra powder in 100 liters of water. Stir thoroughly with the help of a stick. Keep for 2 hours for dissolution of the disinfectant. Spray Asthra solution in the rearing house.

5. Preparation of 0.3% slaked lime solution: For preparing 100 litres of 0.3% slaked lime solution, take 300 g of slaked lime powder and make a paste. Add this paste to the rest of water and stir well. Keep for 10 minutes and use the supernatant for disinfection.

Bed Disinfectants: Hence, colony hygiene is relevant to the fight against diseases in response to several findings in the study of rearing silkworms. Used for controlling bacterial transmission to beds, slaked lime powder is used at each moult for humidity control and to eliminate disease bearing germs. Disinfectants are antifungal, antibacterial, antiviral and antimicrosporidian and have to be used when the schedule demands. Slaked lime dust is used every time larvae settle for moult; other disinfectants are applied post moult and mulberry fed after every 30 minutes. Exfoliants for the bed stop the transmission of diseases but do not treat existing ones. Measures that should be taken include refraining from dusting on moulting silkworms and also use of goggles, face shields, gloves and face masks to avoid contact and inhalation respectively.

Conclusion

Effective disinfection in silkworm rearing is essential for controlling diseases and ensuring healthy silkworm colonies. A combination of physical and chemical methods, along with a strict disinfection schedule, helps prevent pathogen spread and improves silk yield.

The use of appropriate disinfectants, such as formalin, chlorine dioxide and slaked lime, enhances disease management. Regular monitoring and correct application techniques are key to successful silkworm farming.

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