

## DECOL - A NEW GENERAL DISINFECTANT EFFECTIVE FOR CONTROLLING SECONDARY PEBRINE CONTAMINATION IN SILKWORM CROPS

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**ABSTRACT:** In sericulture certain general disinfectants are available in the market via; Formalin, Bleaching powder, Chlorine dioxide etc which are having certain disadvantages like corrosiveness, non-acceptable odour, irritation to eyes and throat, carcinogenicity and user non friendliness. DECOL, a new wide spectrum general disinfectant has been formulated by SSSL, Kodathi, Bangalore with certain phenolic derivatives based on their biocidal properties along with surfactant, solvent and water as a diluent which has certain advantages over existing disinfectants. Decol is non corrosive to metals and alloys, pleasant and acceptable odour, safe to the user and to the environment, bio-degradable, economical and cost effective. Keeping in view, the above field problems, Decol has been tested in the laboratory in simulated conditions and found very effective in controlling secondary pebrine contamination in silkworm crops. Decol was tested and certified as safe to use in sericulture by Industrial Toxicology Research Centre (ITRC), CSIR, Lucknow, UP, Govt. of India.

**KEY WORDS:** Disinfectant, Silkworm diseases, Hygiene, Decol.

The purpose of a disinfectant is to kill the microorganisms. Use of general disinfectant has become most essential to check/prevent the contamination in the rearing environment and to ensure good yield in sericulture. Crop loss due to incidence of silkworm diseases has been a regular feature of Indian sericulture scenario. Disease caused by various infectious pathogens viz., virus, bacteria, fungi and microsporidians take a heavy toll of cocoon crops in the field every year. Improper and unhygienic rearing conditions result in wide spread of contamination due to various silkworm diseases. Now a days, use of disinfectant has become a novel tool to check the contamination of rearing environment. Among all the diseases of silkworm, pebrine disease is most dreaded disease which is caused by a highly virulent parasitic Microsporidian, *Nosema bombycis*. The disease is unique, as it is transmitted both horizontally (secondary contamination) and vertically (transovarian transmission) in the silkworm. This unique feature of the disease makes it difficult to eliminate completely and forms the major obstacle for successful silkworm rearing and production of pebrine free cocoons. In the field during silkworm rearing most of the times pebrine spores are not being detected at larval stage. Surprisingly at moth stage pebrine is noticed. Then it is believed that infection have occurred in silkworm larvae during the course of rearing periods through secondary contamination. Authors have understood very clearly the prevailing field problems and have tried to give the solution to avoid secondary pebrine contamination in silkworm crops.

The mulberry silkworm, *Bombyx mori* L. is susceptible to different diseases caused by microsporidian, virus, bacteria and fungus. Disinfection and maintenance of hygiene are the most important factor for prevention of silkworm diseases in the rearing. Various disinfectants like; formalin (Kagawa, 1980), Bleaching powder (Kobayashi et al., 1968; Balavenkatasubbaiah et al., 1994a,b),

Iodine compounds (Kawakami, 1970; Venketa Reddy et al., 1990), Calcium hydroxide (Ishiwata & Zhou, 1968), Chlorine dioxide in combination of lime (Balavenkatasubbaiah et al., 1999) have been used in sericulture industry for disinfection of rearing houses/appliances. Frequently recommended disinfectants such as formalin, bleaching powder, chlorine dioxide with booster biocide, Idophore are having one or other disadvantages like; corrosiveness, non-acceptable odour, irritation to eyes and throat, carcinogenicity and user non-friendliness. There are few general disinfectants available in the market, most of them contain hazardous chemicals causing serious environmental and health hazards among the users. Keeping this in view, a broad spectrum new general disinfectant "Decol" was developed at Silkworm Seed Technology Laboratory (SSTL), Kodathi, Bangalore for use in sericulture.

Decol is a synergistic blend of more than one active and formulation is based on selected phenolic derivatives. Decol has showed 100% biocidal effectiveness to all silkworm pathogens viz., virus, bacteria, fungus and microsporidians. Its biocidal property is effective at all working temperatures and has prolonged effectiveness. Decol does not corrode copper, brass and aluminium metals and their alloys. Decol has pleasant odour, user and environmental friendly. Decol is biodegradable and most economical. Decol can be used for various sericultural operations in recommended concentrations.

#### MATERIALS AND METHODS

The *N. bombycis* spores were collected from pebrine infected silkworm and were purified by iso-density equilibrium centrifugation using percoll (Sato & Watanabe, 1980). Purified *Nosema bombycis* spores  $1 \times 10^7$  spores/ml was treated with 1% Decol for 30 min. to kill the pathogen. Later on, treated *N. bombycis* spores were smeared onto the mulberry leaves and fed to silkworm (after second moult) following standard inoculation method. Later on, normal mulberry leaves were fed to silkworm throughout rearing period. *N. bombycis* inoculated control batch (without Decol treatment) was also kept for comparison. After the completion of rearing, cocoons were kept for emergence and individual silk moths were tested for the pebrine incidence. In treated batch no pebrine incidence was recorded whereas in control batch 100% pebrine incidence was recorded at moth stage (Table 1).

Another experiment was conducted in simulated conditions by contaminating mulberry leaves with *Nosema bombycis* pebrine spores. For this mulberry leaves were contaminated with pebrine spores ( $1 \times 10^7$  spores/ml) and sprayed with Decol(1%) by following standard methods and fed to silkworm larvae. Control batch was also kept for comparison where mulberry leaves were sprayed with distilled water. Rearing was conducted following standard rearing method. All the rearing parameters were assessed. The disinfectant did not have any adverse effect on silkworm growth, health and economic characters (Table 2, 3) and the mulberry leaf quality was not affected due to Decol.

Mulberry leaves were disinfected with Decol (1%) in the garden and used for silkworm rearing. Mulberry leaves were disinfected once during each stage of silkworm with an additional disinfection of mulberry leaves during fifth stage of silkworm (on fifth day). The disinfected mulberry leaves were utilized for the silkworm rearing (Table 4). Disinfection of mulberry leaves with 1% Decol is economical. It is also very useful for generation of pebrine free silkworm seed. Authors feel if secondary pebrine contamination is checked/prevented it will be boon for the silk industry.

## RESULTS AND DISCUSSION

Disinfection of mulberry leaves in the garden with 1% Decol was found to be 100% effective in inactivating the *Nosema bombycis* spores and no pebrine incidence was recorded in treated batches whereas in control batches, 100% pebrine incidence was recorded at moth stage (Table 1). Further, 1% Decol did not have any adverse effect on silkworm growth, health and economic characters (Table 2, 3) and the mulberry leaf quality was not affected due to Decol.

Phenolic compounds have a variety of antimicrobial applications. They are used as the active ingredient in hard surface disinfectants, germicidal soaps, lotions, antiseptic and as preservatives institutional products. Phenolic compounds are appropriate for use in aqueous or aqueous/alcohol formulations. Germicidal action of phenolic derivatives was conducted by different workers (Klarmann & Shternov, 1936; Rettgur et al., 1929; Read & Miller, 1932; Terleckyi & Axler, 1987). Phenol and its derivatives exhibit several types of bactericidal action. At higher concentrations these compounds act as a gross protoplasmic poison, penetrating and disrupting the cell wall and precipitating the cell proteins (Copper, 1912, 1913). However, at lower concentrations phenol and its derivatives inactivate essential enzyme systems.

In sericulture certain general disinfectants are available in the market viz; Formalin, bleaching powder, chlorine dioxide, Iodophores. which are having certain disadvantages like; corrosiveness, non-acceptable odour, irritation to eyes and throat, carcinogenicity and user non friendliness. Decol has been formulated with certain phenolic derivatives based on their biocidal properties along with surfactant, solvent and water as a diluent which has certain advantages over existing disinfectants. Decol is non corrosive to metals and alloys, effective at all working temperatures, with prolonged effectiveness, pleasant and acceptable odour, biodegradable, user and environmental friendly. Required concentration of Decol can be prepared with drinking water or tap water, hardness of the water does not affect its quality. Samson et al. (1995) tested phenolic compound against silkworm pathogens and found effective against silkworm pathogens. Decol was tested in the laboratory as well as farmers level. Results indicated that Decol was found 100% effective in inactivating pathogens causing diseases in the silkworm. Decol was evaluated for its safety and application in sericulture by Industrial Toxicology Research Centre (ITRC), Lucknow, Government of India and has been certified that it is safe for use in sericulture at recommended concentration. Keeping this in view, Decol has been introduced in sericulture for disinfection of rearing house/appliances, mulberry leaves in the garden and maintenance of rearing and personal hygiene.

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Table 1. Efficacy of Decol against *Nosema bombycis* spores through disinfection of mulberry leaves. Race: CSR2

Treatment	ERR (Yield / 10,000 larvae)		SCW (g)	SSW (g)	SR (%)	Emergence (%)	Pebrine incidence (%)
	No.	Wt.					
Decol	9617	17.67	1.84	0.44	22.96	96.34	0.00
Std	87	0.21	0.01	0.01	0.58	0.57	0.00
Control	3100	4.05	1.32	0.26	22.01	29.88	100.0
Std	593	0.68	0.10	0.02	2.08	3.80	0.00
CD(P<0.05)							
Trial	NS	NS	NS	NS	NS	NS	-
Trt	274	0.10	0.034	0.009	0.80	1.46	-
Trtx Trial	NS	NS	NS	NS	NS	NS	-

Table 2. Effect of feeding of Decol disinfected mulberry leaves on rearing performance.

Race: CSR2

Treatment	ERR (Yield/ 10,000 larvae)		SCW (g)	SSW (g)	SR (%)	Disease incidence (%)			
	No.	Wt.				Fla	Gra	Peb	Mus
Decol	9107	15.52	1.704	0.397	22.54	0.00	0.00	0.00	0.00
Std	287	1.109	0.110	0.055	2.32	0.00	0.00	0.00	0.00
Control	8296	13.73	1.701	0.386	22.68	3.00	2.00	0.00	0.00
Std	386	0.94	0.109	0.046	2.20	0.78	0.78	0.00	0.00
CD (P<0.05)									
Trial	NS	0.385	0.026	0.017	1.28	0.23	NS	-	-
Trt	2.11	0.314	NS	NS	NS	NS	0.23	-	-
Trtx Trial	NS	NS	NS	NS	NS	NS	NS		

Table 3. Effect of feeding of Decol disinfected mulberry leaves on grainage performance.

Race: CSR2

Treatment	Emergence (%)	Pupation Rate (%)	Laying Recovery (%)	Fecundity (No.)	Hatching (%)
Decol	96.29	92.0	35.6	467.3	95.70
Std	0.91	1.0	1.26	10.16	1.31
Control	95.03	91.0	34.95	444.0	93.77
Std	1.11	1.10	1.16	4.95	1.30
CD (P<0.05)					
Trial	0.34	0.36	0.38	NS	NS
Trt	0.28	0.28	0.31	3.60	0.67
Trtx Trial	NS	NS	NS	NS	NS

Table 4. Schedule for disinfection of mulberry leaves (V1 variety) for 100Dfls of silkworm rearing.

Race: CSR2

Sl.No	Approx. Quantity of Leaf required (kgs)	Silkworm stage	Quantity of Decol (1%) required (Ltr)	Total Cost (Rs.)	Disinfection
1	15	I&II	3	1.59	once
2	20	III	4	2.12	once
3	200	IV	40	21.2	once
4	1120	V	193	102.3	Twice
Total	1355		240	127.3	5

Note: i) Cost of Decol (con.) = Rs 58/-Litre  
 ii) Cost of diluted Decol (1%) = Rs 0.58/-Litre