Biological Forum
an International Journal 17(7): 182-185(2025)
ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Feeding Pesticides Sprayed Mulberry Leaves on Grainage Performance of Silkworm

Basanagouda Jekinakatti[1*], Doreswamy C.[2], Ashish S. Karur[1], Pavithra M.R.[1] and Tejaswini A.S.[1]
[1]Department of Sericulture, College of Agriculture, GKVK, Bengaluru (Karnataka), India.
[2]College of Agriculture, Chamarajanagara (Karnataka), India.

(Corresponding author: Basanagouda Jekinakatti)*
(Received: 20 April 2025; Revised: 01 June 2025; Accepted: 28 June 2025; Published online: 17 July 2025)
(Published by Research Trend)

ABSTRACT: A study was conducted to evaluate the impact of feeding pesticide-sprayed mulberry leaves on the grainage performance of silkworms. Five commonly used pesticides for mulberry pest control were tested: Azadirachtin 1 % (2 mL/L), Chlorfenapyr 10 SC (1.5 mL/L), Orgomite (2.5 mL/L), Wettable Sulphur 80 WP and Era Safeguard. Silkworms were fed with treated leaves at intervals of 5, 10, 15 and 20 days after spraying (DAS). Results indicated that Azadirachtin and Chlorfenapyr were highly toxic up to 15 DAS, significantly reducing pupation rate. Among the treatments, Orgomite exhibited the least toxicity to silkworms at 10 DAS, maintaining better pupation, moth emergence, fecundity and hatching rates. At 15 DAS, Chlorfenapyr showed reduced toxicity. Overall, Orgomite and Chlorfenapyr 10 SC were found effective against both mites and mulberry leaf roller with safety periods of 10 and 15 DAS, respectively. The study concludes that Orgomite is the safest option for mulberry pest management in seed crops without compromising silkworm grainage performance.

Keywords: Pesticide, Mulberry, Toxicity, Silkworm, Grainage.

INTRODUCTION

Sericulture is considered one of the most profitable and sustainable livelihood options for farmers of all types ranging from small and marginal holders with limited resources to large landowners with substantial means. Sericulture is not only a labour-intensive activity but also a significant source of income. It provides employment to around 7.85 million people across rural and semi-urban areas in India, contributing substantially to livelihood generation (Raju *et al*., 2020). India is the only country in the world that produces all four varieties of commercial silk mulberry, tasar, eri and muga and ranks second globally in mulberry silk production (Murugesh *et al*., 2004). Its major appeal lies in the quick returns it offers, thanks to its short production cycle. Moreover, as a largely indoor-based activity, sericulture is not bound by seasonal limitations and can be practiced throughout the year. When adopted as a full-time venture, it ensures regular income generation and stable employment. Sericulture offers valuable employment opportunities to the rural poor, with women comprising nearly 60 percent of the workforce. It plays a significant role in empowering women and supporting rural livelihoods (Brahma *et al*., 2019). The economics of silk production largely depends on the quality of cocoons produced by the silkworm, which is directly influenced by the fulfillment of its nutritional requirements (Gunasekhar and Somayaji 2019). In sericulture, grainage plays a vital role as it centers on generating healthy silkworm eggs, which significantly influences the effectiveness of silkworm rearing and the quality of the silk obtained. The production of robust and disease-free silkworm eggs is essential for effective silk production. These eggs serve as the cornerstone of the entire process, affecting both the quality and quantity of cocoons. The silkworm is a specialized insect that exclusively consumes mulberry leaves. Mulberry serves as the primary element in silkworm cultivation. Mulberry is a perennial crop that is susceptible to various pests and diseases, making crop protection measures essential to prevent economic losses. Farmers over reliance on chemicals in their crop protection methods results in residue build-up on the leaves, which in turn negatively impacts the growth and development of vulnerable silkworms (Bhosale and Kallapur 1987).

The application of insecticides in mulberry pest management should be done selectively, as they can threaten silkworms. There are new-generation chemicals on the market that are quite effective and choosing the most suitable insecticides compared to older ones requires evaluating their effectiveness against mulberry pests and their safety intervals for silkworms. To investigate this issue, a study was carried out to examine the impact of consuming pesticide-treated mulberry leaves on grainage performance of silkworms.

MATERIAL AND METHODS

The study was carried out at the College of Agriculture, KVK, Chamarajanagara during 2022-23 and mulberry leaves of well-established V-1 variety was taken into consideration to know the feeding effect of pesticide-treated mulberry leaves on grainage performance of mulberry silkworm of commercial bivoltine silkworm hybrid (FC1) were reared by following standard silkworm rearing practices outlined by Dandin and Giridhar (2014). The eggs of commercial bivoltine silkworm hybrids (FC1) were procured from NSSO, CSB, Bengaluru. the worm were reared on pesticide treated mulberry leaves according to schedule of treatment. The pesticides used for the study are Chlorfenapyr 10 SC (1.5 mL/L), Wettable Sulphur 80 WP (2 g/l), Orgomite (2.5 mL/L), Era Safeguard (2.5 mL/L) and Azadirachtin 1 per cent (2 mL/L) at interval of 5, 10, 15 and 20 days after spraying (DAS). The generated data is laid out in Randomized Complete Block Design (RCBD) with seven treatments and four replications.

RESULTS AND DISCUSSION

A. Pupation Rate

At 5 and 10 DAS, the minimum pupation rate was recorded in T1 (Chlorfenapyr 10 % SC @ 1.5 ml/l) followed by T4 (Era Safeguard @ 2.5 ml/l), T2 (Wettable sulphur 80 WP @ 2g/l) and maximum in T7 (control) and T6 (Water spray) followed by, T3 (Orgomite @ 2.5 ml/l). The pupation rate in case of T5 (Azadiracthin 1 %) at 5 and 10 DAS was found to be zero this is because of 100 per cent mortality of silkworms during rearing. There was no significant difference between pupation rate of all the treatments at 15 and 20 DAS (Table 1). The minimum pupation rate at 5 and 10 DAS in case of T1, T2 and T4 might be due to toxicity of pesticides which made the larvae unable to transform into pupa.

The survival rate of pupae was affected drastically by the HCH treatment and it was lowered as the time of application was advanced (Bhagyalakshmi *et al.*, 1995). It was discovered that, in comparison to Dichlorovos, the Neem pesticide significantly inhibited the various stages of silkworm development intern leads to abnormalities in the larvae and pupae of silkworms exposed to pesticides (Kumutha, 2013a). Novaluron exposure impairs the midgut and may affect the physiological functions of this organ. Novaluron additionally compromises several phases of insect development such as rupture in the integument, complete cessation of feeding, late development, incomplete ecdysis and production of defective cocoons (Santorum *et al*., 2019).

Moth Emergence Rate. At 5 and 10 DAS, the minimum moth emergence was recorded in T1 (Chlorfenapyr 10 % SC @ 1.5 ml/l) followed by T4 (Era Safeguard @ 2.5 ml/l), T2 (Wettable sulphur 80 WP @ 2g/l) and maximum in T7 (control) followed by T6 (Water spray), T3 (Orgomite @ 2.5 ml/l). There was no significant difference between moth emergence of all the chemicals at 15 and 20 DAS (Table 2).

Insecticides could possibly end up in deformities in pupae and hinder their successful emergence. There was a considerable reduction in silkworm moth emergence due to HCH treatment (Bhagyalakshmi *et al*., 1995). Due to higher concentration (0.05 %) of malathion, the moth emergence percentage was significantly decreased than at lower concentration (0.025 %) (Shigeharu, 1981).

Fecundity. At 5 and 10 DAS, the minimum fecundity was recorded in T1 (Chlorfenapyr 10 % SC @ 1.5 ml/l) followed by T4 (Era Safeguard @ 2.5 ml/l), T2 (Wettable sulphur 80 WP @ 2g/l) and maximum in T7 (Control) followed by T6 (Water spray), T3 (Orgomite @ 2.5 ml/l). There was no significant difference between moth emergence of all the treatments at 15 and 20 DAS (Table 3).

The adults emerged from silkworm larvae fed with pesticides treated leaves provided less number of eggs compared to control (Kumutha *et al*., 2013b). The number of eggs laid by the females are reduced in pesticide (HCH) treated silkworms (Bhagyalakshmi *et al*., 1995). The decreased egg laying by silkworms emerged from larvae fed with pesicides (Thiamethoxam 0.015%, Diafenthiuron 0.0633% and Clothianidin 0.0047%) treated mulberry leaves compared to control (Patnaik *et al*., 2011). The neem based insecticides application interrupted the coupling and cause lessening of fecundity (Pandey and Tiwari 2011).

Table 1: Effect of feeding the insecticide treated mulberry leaves on Pupation Rate.

Treatment details	Pupation Rate (%)			
	5 DAS	**10 DAS**	**15 DAS**	**20 DAS**
T_1: Chlorfenapyr 10 % SC @ 1.5 mL/L	81.50	84.89	91.25	97.32
T_2: Wettable Sulphur 80 WP @ 2 g/l	87.74	90.93	94.22	98.23
T_3: Orgomite @ 2.5 mL/L	89.25	92.18	95.25	98.74
T_4: Era Safeguard @ 2.5 mL/L	82.39	85.22	91.96	97.82
T_5: Azadirachtin 1 % @ 2 mL/L	-	-	92.13	97.99
T_6: Water spray	100	100	100	100
T_7: Untreated control	100	100	100	100
F-test	**	**	NS	NS
S.Em±	1.60	1.67	2.30	0.75
CD @ 5 %	4.76	4.97	-	-

*Significant at 5 %; ** Significant at 1 %; DAS - Days after spraying.

Table 2: Effect of feeding the insecticide treated mulberry leaves on moth emergence (%).

Treatment details	Moth emergence (%)			
	5 DAS	10 DAS	15 DAS	20 DAS
T_1: Chlorfenapyr 10 % SC @ 1.5 mL/L	81.75	85.99	92.05	96.07
T_2: Wettable Sulphur 80 WP @ 2 g/l	86.25	92.66	94.35	97.44
T_3: Orgomite @ 2.5 mL/L	87.50	93.91	96.08	98.10
T_4: Era Safeguard @ 2.5 mL/L	82.64	86.55	92.91	96.57
T_5: Azadirachtin 1 % @ 2 mL/L	-	-	93.52	97.10
T_6: Water spray	100	100	100	100
T_7: Untreated control	100	100	100	100
F-test	**	**	NS	NS
S.Em±	1.23	1.77	2.02	1.32
CD @ 5 %	3.64	5.25	-	-

*Significant at 5 %; ** Significant at 1 %; NS- Non significant; DAS - Days after spraying.

Table 3: Effect of feeding the insecticide treated mulberry leaves on Fecundity (eggs/laying).

Treatment details	Fecundity (eggs/laying)			
	5 DAS	10 DAS	15 DAS	20 DAS
T_1: Chlorfenapyr 10 % SC @ 1.5 mL/L	465.62	488.62	506.89	521.49
T_2: Wettable Sulphur 80 WP @ 2 g/l	502.48	525.48	534.05	535.40
T_3: Orgomite @ 2.5 mL/L	506.76	529.76	536.68	542.16
T_4: Era Safeguard @ 2.5 mL/L	472.75	498.25	519.76	526.71
T_5: Azadirachtin 1 % @ 2 mL/L	-	-	522.79	530.63
T_6: Water spray	553.91	553.50	549.76	546.91
T_7: Untreated control	568.61	568.61	568.61	568.61
F-test	**	**	NS	NS
S.Em±	5.30	5.89	12.97	10.37
CD @ 5 %	15.74	17.49	-	-

*Significant at 5 %; ** Significant at 1 %; NS- Non significant; DAS - Days after spraying.

Egg Hatching Rate. At 5 and 10 DAS, the minimum hatching percentage was recorded in T1 (Chlorfenapyr 10 % SC @ 1.5 ml/l) followed by T4 (Era Safeguard @ 2.5 ml/l), T2 (Wettable sulphur 80 WP @ 2g/l) and maximum in T7 (Control) followed by T6 (Water spray), T3 (Orgomite @ 2.5 ml/l). However, there was no significant difference between hatching percentage of all the treatments from 5 and 20 DAS (Table 4). However, maximum hatching percentage was recorded in all the treatments irrespective of intervals which indicate that the selected insecticides do not affect the hatchability of silkworm eggs.

Neem products have been shown to significantly lower the number of diamondback moth eggs that hatch and to cause significant mortality in the larvae that feed on treated leaves (Liang *et al.*, 2003). Chlorantraniliprole, a widely used pesticide, has been demonstrated to have severe toxicity and sub-lethal effects on *Spodoptera litura* moths, including decreased fecundity and egg-hatching (Kong *et al*., 2021).

Table 4: Effect of feeding the insecticide treated mulberry leaves on hatching percentage (%).

Treatment details	Hatching percentage (%)			
	5 DAS	10 DAS	15 DAS	20 DAS
T_1: Chlorfenapyr 10 % SC @ 1.5 mL/L	96.25	97.50	98.13	98.63
T_2: Wettable Sulphur 80 WP @ 2 g/l	97.75	98.25	98.17	98.67
T_3: Orgomite @ 2.5 mL/L	98.25	98.75	98.11	98.61
T_4: Era Safeguard @ 2.5 mL/L	96.48	97.48	97.86	98.36
T_5: Azadirachtin 1 % @ 2 mL/L	-	-	97.19	97.69
T_6: Water spray	98.25	98.75	98.78	99.05
T_7: Untreated control	99.10	99.10	99.10	99.10
F-test	NS	NS	NS	NS
S.Em±	22.75	22.78	0.71	0.71
CD @ 5 %	-	-	-	-

*Significant at 5 %; ** Significant at 1 %; DAS - Days after spraying

CONCLUSION

The present study indicates that the insecticides Chlorfenapyr 10 SC, Azadirachtin 1 %, and Era Safeguard exhibited significant toxicity to silkworms for up to 15 days post-application. In contrast, Orgomite was found to be comparatively safer when assessed at 10 days after spraying, followed by Wettable sulphur 80 WP. Based on these findings, Orgomite and Chlorfenapyr 10 SC may be considered suitable options for managing mites and mulberry leaf roller in silkworm seed crops with recommended safety intervals of 10 and 15 days post-treatment, respectively, to minimize adverse effects on silkworm growth and development.

FUTURE SCOPE

The biochemical and histological changes in silkworms caused by sub-lethal doses of pesticides can be explored, which may not immediately affect survival but impair grainage performance.

Acknowledgement. I sincerely extend my heartfelt gratitude to Prof. (Dr.) C. Doreswamy, my major advisor for his invaluable guidance and support throughout the course of my study. I am also deeply thankful to the members of my advisory committee for their continuous encouragement and insightful suggestions. My sincere thanks to the Department of Sericulture, UAS, GKVK, Bengaluru and the College of Agriculture, Chamarajanagara for providing the necessary support and facilities for the successful completion of my research work.

REFERENCES

Bhagyalakshmi, A., Venkata Reddy, S., Ramamurthi, R. and Reddy, P. S. (1995). Studies on the effect of hexachlorocyclohexane on the growth and silk qualities of silkworm, *Bombyx mori* L. *Chemistry and Ecology*, *11*, 97-104.

Bhosale, S. H. and Kallapur, V. L. (1987). Changes in the metabolic fuel reserves of the V instar *Bombyx mori* following endosulfan treatment. *Entomon.*, *10*, 281-283.

Brahma, S., Sarma, R. and Nath, R. K. (2019). Livelihood improvement through sericulture in Kokrajhar district of Assam-A key for women empowerment. *International Journal of Current Microbiology and Applied Sciences*, *8*(12), 2762-2766.

Dandin, S. B. and Giridhar, K. (2014). Handbook of Sericulture Technologies, *Central Silk Board*, Bangalore.

Gunasekhar, V. and Somayaji, A. (2019). Effect of endophytic bacteria *Burkholderia cepacia* on growth, cocoon characters and enzyme activity of silkworm, *Bombyx mori* L. *South Asian Journal of Research in Microbiology*, *5*(4), 1-8.

Kumutha, P. (2013a). Effect of Pesticides on the Metamorphosis of Silkworm *Bombyx mori*, *International Journal of Molecular Zoology*, *3*(3), 10-13.

Kumutha, P., Padmalatha, C. and Ranjit Singh, A. J. A. (2013b). Effect of pesticides on the reproductive performance and longevity of *Bombyx mori* L. *International Journal of Current Microbiology and Applied Sciences*, *2*(9), 74-78.

Kong, F., Song, Y., Zhang, Q., Wang, Z. and Liu, Y. (2021). Sublethal Effects of Chlorantraniliprole on *Spodoptera litura* (Lepidoptera: Noctuidae) Moth: Implication for Attract-and-Kill Strategy. *Toxics*, *9*, 20.

Liang, G. M., Chen, W. and Liu, T. X. (2003). Effects of three neem-based insecticides on diamondback moth (Lepidoptera: Plutellidae). *Crop protection*, *22*(2), 333-340.

Murugesh, K. A., Bhaskar, R. N. and Mahalingam, C. A. (2004). Management of uzi fly by some plant leaf extracts. *Sericulture Technology Transfer*, *82*, 5.

Pandey, J. P. and Tiwari, R. K. (2011). Neem based insecticides interaction with development and fecundity of red cotton bug *Dysdercus cingulatus* Fab. *International Journal of Agricultural Research*, *6*(4), 335-346.

Patnaik, M., Bhattacharya, D. K., Kar, N. B., Das, N. K., Saha, A. K. and Bindroo, B. B. (2011). Potential efficacy of new pesticides for the control of mulberry whitefly and its impact on silkworm rearing, *Journal of Plant Protection Science*, *3*(1), 57-60.

Raju, P. J., Mamatha, D. M. and Seshagiri, S. V. (2020). Sericulture Industry: A Bonanza to Strengthen Rural Population in India. In *Environmental and Agricultural Informatics: Concepts, Methodologies, Tools, and Applications*, 366-387.

Santorum, M., Brancalhao, R. M. C., Guimaraes, A. T. B., Padovani, C. R., Tettamanti, G. and Dos Santos, D. C. (2019). Negative impact of Novaluron on the nontarget insect *Bombyx mori* (Lepidoptera: Bombycidae). *Environmental Pollution*, *2*(49), 82-90.

Shigeharu Kuribayashi (1981). Studies on the effect of pesticides on the reproduction of the silkworm, *Bombyx mori* L. *Journal of Toxicological Sciences*, *16*(4), 423-431.

How to cite this article: Basanagouda Jekinakatti, Doreswamy C., Ashish S. Karur, Pavithra M.R. and Tejaswini A.S. (2025). Effect of Feeding Pesticides Sprayed Mulberry Leaves on Grainage Performance of Silkworm. *Biological Forum, 17*(7): 182-185.