

IMPACT OF INSECTICIDES ON MORUS ALBA AGAINST THE MULBERRY LEAF BORER (AMATA PASSALIS; LEPIDOPTERA: AMATIDAE

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ABSTRACT

For two annual cycles, a field study on the seasonal occurrence of common mulberry leaf-eating pests was conducted in the Mirzapur district of Uttar Pradesh. The current study was carried out during Kharif season. According to the study area's results, different pests are harming the Mulberry crop, which is costing sericulture farmers a lot of money. From a number of mulberry gardens, the current study classification also determined the occurrence, kind, and symptoms of defoliator insect populations in the mulberry field. Botanical insecticides against mulberry leaf borer on mulberry leaves and fruits were tested during the Kharif season (June to October) in a field trial. The insecticides were applied twice, fifteen days apart. Chlorpyrifos 20 EC@ 300g i.e. ha⁻¹ was the most effective treatment against mulberry leaf borer, followed by Neem oil @ 2 percent first spray (4.30, 4.08 and 3.52 larvae m⁻² at 3, 5 and 7 days after spray, respectively) and second spray (3.00, 2.85 and 3.28 larvae m⁻² at 3, 5 and 7 days after spray, respectively), and NSKE @ 5 percent after first spray (4.62, 4.18 and 3.81 larvaem⁻² at 3, 5 and 7 days after spray, respectively) and second spray (3.12, 3.09 and 3.37 larvae m² at 3, 5 and 7 days after spray, respectively). Chlorpyrifos 20 EC@ 300g i. e. ha⁻¹ after first spray (1.97, 1.74 and 1.53 larvae m⁻² at 3, 5, and 7 days after spray, respectively) and second spray (1.51, 1.54 and 1.93 larvae m⁻² at 3, 5 and 7 days after spray, respectively) was the most effective treatment. The untreated plot had the biggest larval population. Plants sprayed with Chlorpyrifos 20EC @ 300 g a. i. ha⁻¹ produced the greatest yield of green mulberry leaves (53.12 qha⁻¹), followed by Neem oil at 2% (43.53 qha⁻¹) and NSKE at 5% (42.11 qha⁻¹), with the lowest yield coming from the untreated control plot (32.16 qha⁻¹).

Keywords: *Lepidoptera, Mulberry leaf, mulberry leaf borer, insecticides.*

INTRODUCTION

The contemporary sericulture technique not only boosted silk output and provided significant rewards, but it also significantly disrupted the natural seri-ecosystem. The silkworm's pest population and its host plants have grown, and new pests are often erupting. It severely harms silk host plants, which led to a decline in the quality and quantity of silk host plant leaves and, ultimately, variations in cocoon production (Adipala, E., *et. al.*, 2005). By implementing appropriate production technology along with management of mulberry pests and diseases, the productivity of silk per unit area can be improved. On mulberry trees, there are around 300 known species of pests, both insects and non-insects (Dolwadi, M.M. *et.al.*, 1984). Aside from the mites and mollusks (Hednderson, C.F. *et. al.*, 1955), the major insect orders known to be the

pests of mulberry, in order of the largest number of species attacking the mulberry, are Lepidoptera, Hemiptera, Coleoptera, Thysanoptera, Orthoptera, and Isoptera. In every agricultural ecosystem, defoliating insects feed on a variety of host plants. They negatively affect plant health and output. Defoliation can have a negative impact on plant growth, depending on its length and intensity. The most important factor in controlling defoliators is early detection and management, since they inflict significant harm to mulberry. The two main types of defoliators that harm plants using their chewing mouthparts are beetles and caterpillars. Grasshoppers, katydids, and other related chewing insects are among the few that occasionally harm the plants [4]. The mulberry fruits are made up of 3.99% lipids, 26.61% protein, 56.24% carbs, 8.60% moisture, 3.84% ash, 1.38% crude fiber, 1.51% gross energy, and 54.85% nitrogen free extract (**Owolabi et.al., 2012 & Irandi et. al., 2000**). The mulberry leaf borer complex, which includes *Maruca vitrata* (Fabricius), *Lampides boeticus* (L.), *Helicoverpa armigera* (Hubner), *Etiellazinck enella* Treitsche, *Adisuraat kinsoni* Moore, and *Exelastis atomosa*, poses a significant threat to the cultivation of mulberry leaves. The overuse of extremely hazardous chemical insecticides to control insect pests at short intervals has had several negative consequences, including residual toxicity, insecticide resistance, pest resurgence, the killing of natural predators, and environmental contamination. Given this background, managing the mulberry leaf borer complex with botanicals and newer chemicals becomes more important. Azadirachtin containing compositions lower the larval population of mulberry leaf borers and help increase production (**Singh and Yadav, 2006**). Insect pest assaults have been shown to account for up to 70% of the loss in Mulberry leaf production (**Adipala, et. al., 2005**), which is the primary limiting factor in its cultivation. The botanical insecticides are a naturally occurring group of insecticides that tend to work gradually, protect crops, and have little residual impact. As a result, mulberry plant pesticides have been suggested as a viable option for plant protection with minimal negative consequences (**Isman, 2006**). The current investigation sought to determine the effectiveness of mulberry insecticides against spotted mulberry leaf and fruit borer on *Morus alba*.

MATERIALS AND METHODS

During the Kharif season, the field experiment took place in the mulberry garden and at the College of Agriculture in Mirzapur, Uttar Pradesh. The experiment was conducted using a randomized block design (RBD) with three replications and eight treatments (Table-1). In the final week of July, the plot size was 5x4 meters (m), and the seeds of Mulberry leaf were sown at a spacing of 45x30 cm (cm). The experiment made use of the mulberry leaf type known as Kanva. With the exception of plant protection, every agronomic procedure was followed as and when necessary. At the first occurrence of mulberry leaf borer, sprays of botanical and synthetic pesticides were administered, and two treatments were carried out. All the sprayings were performed using a knap sack sprayer every 15 days. Before each spray, 3, 5, and 7 days after each spray, the number of mulberry leaf borer larvae were counted by randomly choosing the on em² region and labeling the plants. The yield of green mulberry leaves was measured for each plot and then expressed as quintals per hectare. In accordance with common criteria (**Gomez and Gomez, 1984**), the computed data of mulberry leaf borer larvae were converted into square root values $\sqrt{X+0.5}$. Using the modified formula provided by (**Henderson and Tilton 1955**), the percentage reduction in the larval population compared to the control group was determined.

Table: 1- Different treatment details are below.

TREATMENT DETAILS	
T ₁	Neemoil@2%
T ₂	NSKE@5%
T ₃	Karanjoil@2%
T ₄	Karanj seed powder @ 30 kg ha ⁻¹ T ₅
T ₅	Chilli+Garlicsolution@9 kg ha ⁻¹
T ₆	Chilli solution @ 10 kg ha ⁻¹
T ₇	Chlorpyriphos20EC@2ml ⁻¹
T ₈	Untreated control plain water spray

RESULTS AND DISCUSSION

After each spray, the larval population of mulberry leaf borer in mulberry leaf was significantly reduced in treated plants as compared to untreated plants, according to the data shown in Table-2. The amount of mulberry leaf borer larvae before the first and second sprays did not change significantly. The data gathered here backs up the data that chloropyriphos 20EC@2 mlitre⁻¹ water had the least number of mulberry leaf borer larvae population in mulberry leaf after the first spray, among a variety of botanical and traditional insecticides, i.e., 1.97, 1.74, and infesting green mulberry leaf of Indian bean (Oparaeke, A.M. *et. al.*, 2005 & Kishor, R., 1994). Neem-based extracts protect mulberry leaf plants and lessen mulberry leaf borer. The insect may have ceased feeding because the flowers and mulberry leaves absorbed it via osmotic pressure (Irulandi, S. *et. al.*, 2000 & Narendran., 2001). In Tamil Nadu, Vijay Kumar *et al.* (2005) discovered the presence of the red hairy caterpillar in the CSR and TI centers, while (Rajadurai, S., 1999 & Donald, J.B., 1981) also noted the presence of the mulberry defoliator, which is made up of 13 Lepidoptera, 3 Coleopteran, and 2 Orthopteran species, in the CSR and TI centers in Mysore. Additionally, they are divided into major pests (1 species), sporadic pests (1 species), and minor pests (16 species). In Tumkur district (Karnataka), (Hemalata *et. al.*, 2008 & Millar, I.M., 2000) conducted a field study over two years on the seasonal incidence of common mulberry leaf-eating pests, such as the Bihar hairy caterpillar, leaf roller, and wingless grasshopper. The study found that the infestation was severe to moderate in the rainy and winter seasons, while it was mild in the summer because of these pests. The widespread distribution of Bihar hairy in the oriental region as a sporadic pest of various agricultural crops is shown in Sathe, T.V., 1998, and Sengupta, K, *et. al.*, 1990 & Mahim, A.S. *et. al.*, 2010. Bihar, Andhra, Karnataka, Maharashtra, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, and Punjab are among the states that have reported it as a mulberry pest. Cutworms may be found in India as well as in tropical and subtropical regions of the globe. Andhra Pradesh, Karnataka, and Tamil Nadu are among the places where leaf roller is now found in India. India is the source of the reported Jassids/leaf hoppers (Narayanswamy, T.K., 2001; Siddegowde, D.K., 1995 & Geetabai, M., 1997). As a result, a current survey was carried out in the mulberry garden to look at the

distribution and incidence of the defoliator insect fauna linked to mulberry fields from district of Maharashtra state that causes damage to mulberry plants, which has an impact on the local sericulture industry and economic losses for farmers. The lepidopteran insect pests that harm the mulberry in various regions of the globe are described in a nut shell. The literature indicates that more than 20 lepidopteran species from the families Pyralidae, Arctiidae, Lymantridae, Noctuidae, Geometridae, Amatidae, Syntotomidae, and Tortricidae cause mulberry crop damage in various regions of the world (Owolabi, A.O. *et. al.*, 2012 and Subhasree, S., 2012). The lepidopteran leaf roller *Diaphania puluwerulentalis* (Hampson) has lately become a significant pest in southern India, particularly during the wet and winter months, with a high rate of infestation (Singh, R.N., 1994 & Rangaswamy, G., 1976). We saw similar things during our study time. The wingless grasshopper pest is found throughout India and Malaysia.

Table 2: Effect of insecticides against larva of mulberry leaf borer in Mulberry leaf during Kharif season.

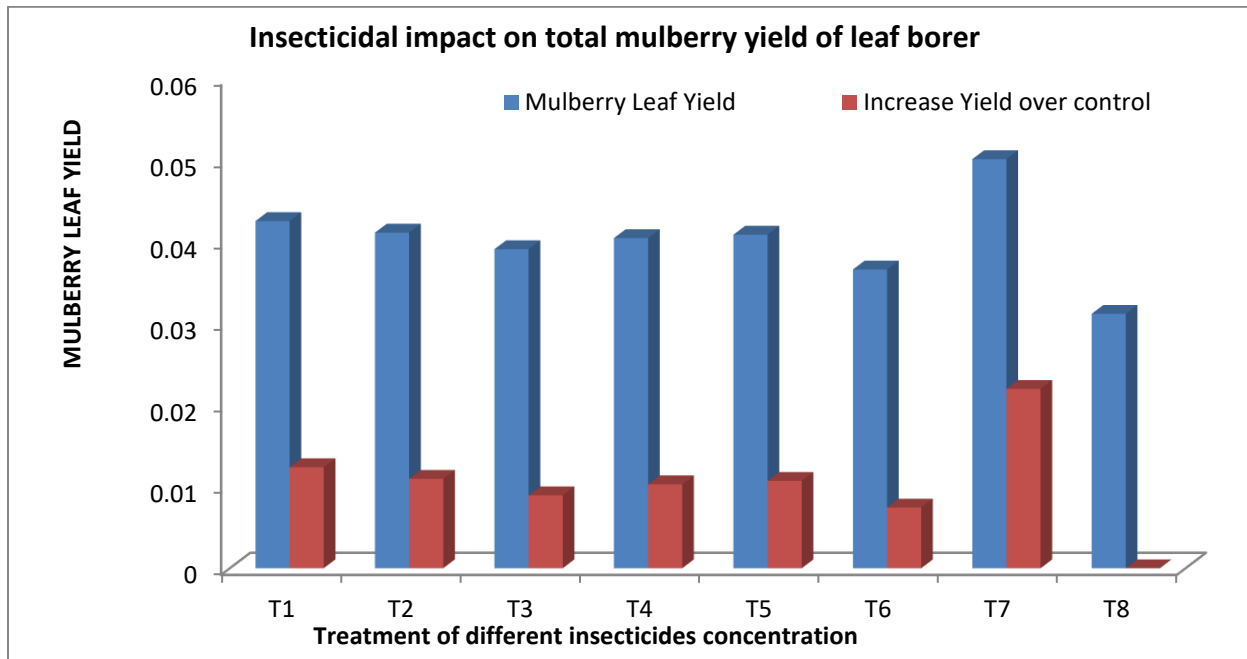
Treatment Con.	(larva em ⁻²)	3DAS	5DAS	7DAS	Mean	PRO C	(larva em ⁻²)	3DAS	5DAS	7DAS	Mean	PROC
T1	16.61 (4.12)	4.30 (2.19)	4.08 (2.14)	3.52 (2.00)	3.97 (2.11)	54.00	13.14 (3.69)	3.00 (1.87)	2.85 (1.83)	3.28 (1.94)	3.04 (1.88)	59.38
T2	17.40 (3.23)	4.62 (2.26)	4.18 (2.16)	3.81 (2.08)	4.20 (2.17)	53.55	13.21 (3.70)	3.12 (1.90)	3.09 (1.90)	3.37 (1.97)	3.19 (1.92)	57.60
T3	20.76 (4.59)	5.67 (2.49)	5.16 (2.38)	5.14 (2.37)	5.32 (2.41)	50.68	12.43 (3.59)	3.53 (2.01)	3.47 (1.99)	3.97 (2.11)	3.66 (2.04)	48.30
T4	17.87 (4.04)	5.25 (2.40)	5.02 (2.35)	4.90 (2.32)	5.06 (2.36)	45.51	13.88 (3.79)	3.47 (1.99)	3.36 (1.96)	3.83 (2.08)	3.55 (2.01)	55.09
T5	18.79 (4.38)	4.94 (2.33)	4.70 (2.28)	4.24 (2.18)	4.63 (2.26)	52.58	13.23 (3.71)	3.27 (1.94)	3.22 (1.93)	3.45 (1.99)	3.31 (1.95)	56.07
T6	20.70 (4.60)	5.97 (2.54)	5.56 (2.46)	5.73 (2.50)	5.75 (2.50)	46.54	13.95 (3.80)	3.64 (2.04)	3.63 (2.03)	4.17 (2.16)	3.81 (2.08)	52.05
T7	17.58 (4.24)	1.97 (1.57)	1.74 (1.50)	1.53 (1.43)	1.75 (1.50)	80.84	14.26 (3.84)	1.51 (1.42)	1.54 (1.43)	1.93 (1.56)	1.66 (1.47)	79.56
T8	17.34 (4.22)	8.11 (2.94)	9.39 (3.13)	9.53 (3.16)	9.01 (3.08)	-	13.66 (3.76)	6.15 (2.58)	8.01 (2.91)	9.18 (3.11)	7.78 (2.86)	-
Sem	-	0.04	0.08	0.05	0.06		-	0.04	0.05	0.06	0.05	
CDat 5%	NS	0.11	0.25	0.14	0.17		NS	0.13	0.16	0.17	0.15	

Note: Figure in parenthesis is square root transformed value, DAS: Days after spraying, PROC: Percent reduction over control

Similar findings were made by Rajadurai, S. 2005 and Vijaya Kumar *et al.*, (2005), who reported that mulberry is infested by the Red hairy caterpillar, *Amasacta alb* is trig a Walker, a major pest of ground nuts, seas am, cow peas, mung beans, cotton, bajara, sorghum (Jawar), finger millet, castor, and a variety of other crops (Kotikal, Y.K. *et. al.*, 1982).

Table 3: Insecticidal impact on total mulberry yield of leaf borer.

Treatment	Mulberry Leaf Yield (qha ⁻¹)	Increase Yield over control (qha ⁻¹)
T1-Neemoil@2%	42.53	12.37
T2-NSKE@5%	41.11	10.95
T3-Karanjoil@2%	39.08	08.92
T4-Karanj seed powder @ 30 kg ha ⁻¹ T5	40.44	10.28
T5-Chilli+Garlicsolution@9 kgha ⁻¹	40.86	10.70
T6-Chilli solution @ 10 kg ha ⁻¹	36.59	07.43
T7-Chlorpyriphos20EC@2ml ⁻¹	50.12	21.96
T8-Untreated control plain water spray	31.16	-----
5Sem	01.37	-----
CD at 5%	04.15	-----



The data presented in **Table-3** indicates that with the application of treatments the mulberry leaf yield of Mulberry leaf was significantly increased as compared to untreated control. The highest mulberry leaf yield was recorded in chloropyriphos treatment (50.12q ha⁻¹) followed by Neem oil @2percent (42.53qha⁻¹) and NSKE @ 5 percent (42.11 qha⁻¹). The lowest yield was recorded in untreated plot (32.16 qha⁻¹) followed by chilli solution10kgha⁻¹ (36.59qha⁻¹).These findings are in agreement with the results obtained by **(Dalwadi et al. 2008)** in Indian bean. The pest is

gregarious in early instars and highly migratory in late instars. Though not a regular pest, it causes extensive damage and economic loss to mulberry crop.

CONCLUSION

In captivity, the species' average lifespan is 62 days. An adult female lays around 305 eggs throughout her 3.87-day lifespan after mating. It is known to reproduce continuously throughout the year and goes through 6 to 11 generations annually. There are eight larval stages. The lengths of the first and final instar larvae are around 1.97 mm and 29.29 mm, respectively. Generally, adults emerge in the hour or two following sunrise. They are prepared for copulation after a day. In various regions of the globe, the mulberry is being harmed by lepidopteron defoliator insect pests in a highly precise manner. During the research time, we made comparable findings. In sandalwood (*Santalum album*) farms in India and Sri Lanka, *Amata passalis* is a major pest that acts as a significant defoliator, endangering timber production by eating leaves and hindering tree development. The gregarious larvae scrape the chlorophyll layer of young leaves before moving on to consume entire leaves, frequently leaving branches completely bare and adding to the plantation's overall vulnerability. In areas with valuable timber, where frequent infestations might result in stunted growth and lower wood quality, this defoliation is especially worrisome. For example, in mulberry fields, severe infestations can defoliate plants, resembling grazing damage and interfering with silkworm farming activities. These effects enhance the pest's overall agricultural danger in tropical areas by including decorative plants. The aforementioned techniques are combined in an integrated pest management (IPM) approach for *A. passalis*, along with routine monitoring of egg clusters on leaf undersides for early intervention and the use of light traps to catch adult moths during peak flight times. In some Indian programs, pheromone traps are used to target adult males in order to interfere with reproduction and track population changes. In Indian forestry initiatives, such IPM strategies in mulberry and sandalwood systems have shown long-term success in preserving plantation health through a combination of biological and cultural methods.

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