

## **EFFECTS OF VARIOUS MANAGEMENT STRATEGIES ON THE MULBERRY PLANT BARK EATING CATERPILLAR DEFOLIATOR SPECIES (INDARBELA QUADRINOTATA)**

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### **ABSTRACT**

*Indarbela quadrinotata* (Walker), sometimes referred to as the bark eating caterpillar, is the main caterpillar species that feeds on mulberry plants. The larvae of this are harmful insect bores into the trunk or junction of branches at night to consume the bark, making it a major pest in the Indian subcontinent. The polyphagous insect pest known as the bark-eating caterpillar causes significant harm to a variety of fruit plants. Uncontrolled mulberry leaf and fruit orchards have a very high incidence of this pest. Given the significance of this pest, a variety of management strategies were tested in real-world field situations at Mulberry garden. The treatments examined included swabbing of insecticide acephate on mulberry leaf and fruits trunk, which effectively reduced the bark eating caterpillar infestation without causing any new ribbon formation by the caterpillar. This was followed by swabbing of profenophos, *Beaveria bassiana*, and a combination of dichlorovos sealer cum healer (IIHR product) +/- copper oxychloride. As it colonized in the mulberry leaf and fruit trunk and also decreased the incidence, the effect of *Beaveria bassiana* had the greatest impact in the trial. The polyphagous wood-boring caterpillar *Indarbela* spp. feeds on bark and targets a wide variety of tree species in India. This pest poses a significant threat to the mulberry leaf and fruit horticulture plantation in several areas of India and the Asia Pacific area. It is regarded as being of national importance because of its destructive character. The walker's *Inderbela quadrinota* has been documented boring into the bark and eating inside older trees, and mulberry gardens' poorly maintained trees are more susceptible to these pests. September to October is the busiest time for this pest. Maintaining a tidy mulberry garden and preventing trees from overwintering might help reduce the invasion of this pest from a management standpoint. In the event of a major infestation, the mulberry leaf and fruit may be successfully protected by the targeted use of insecticides, which also improves the yield and productivity of silkworm cocoons.

**Keywords:** *Mulberry leaf and fruits bark eating caterpillar, Indarbela, management and cocoon.*

### **INTRODUCTION**

The bark eating caterpillar is a polyphagous insect that feeds on a variety of fruits, including mango, mulberry leaves, litchi, citrus, jamun, loquat, mulberry, pomegranate, ber, drumstick, amla, rose, as well as a large number of forest and decorative trees. Bangladesh, Sri Lanka, Burma, Pakistan, and other regions of the Indian subcontinent are all affected by the pest. The most prevalent species in India, *Indarbela quadrinotata* Walker, is found on mango trees. *Indarbila tetraonis* Moore, a significant mulberry leaf and fruit pest, has also been observed

preying on mangoes, particularly when mulberry leaf and fruit trees are present. Other species reported from India are *Indarbela dea* Swinhoe and *Indarbela theivora* Hampson. Organophosphate insecticides like dichlorvos (DDVP), chlorpyrifos, and profenofos are used to treat a broad variety of sucking and chewing pests in the agricultural, domestic, and public health sectors. They function by blocking the action of the enzyme acetylcholinesterase in the neurological system of insects. An oligophagous insect pest, the bark-eating caterpillar, causes harm to a variety of fruit crops as well as venue and decorative trees (Ali et al., 2007). The occurrence of this pest may be detected by the presence of an extended zig zag ribbon-like messy web or galleries composed of fragments of bark pieces and silk excreta, close to the stem or branch angles (Patil and Deshpande, 1990). On mulberry leaves and fruits, two species of bark-eating caterpillar, namely, *Indarbela quadrinotata* walker and *I. tetraonis* Moore, are frequently observed (Haseeb, M., 2005). In Uttar Pradesh's mulberry leaf and fruit-growing orchards, the prevalence of this pest ranged from 56% to 82% (Anonymous, 2000, 2001, 2002, 2003). This pest has a yearly life cycle. The destructive stage is the larvae, which burrows 15 to 25 cm into the trunk or branches, typically at forks or angles. Severe infestation cause young trees to die completely (Butani, D.K., 1979), while stem damage caused by the pest disrupts translocation, which in turn restricts growth and has negative consequences for the tree's ability to produce fruit. The bark-eating caterpillar frequently occurs on mulberry leaves and fruits, and its infestation may be seen anytime of the year (Verma and Khurana, 1978). During the first week of July, the initial incidence of pests was recorded in Gujarat, and the peak incidence occurred during the second week of November (Patel and Patel, 2008). In contrast, in Uttar Pradesh circumstances, its initial incidence was seen in the second week of April, and its highest incidence occurred in the first week of October (Haseeb, M., 2005). The minimum temperature was found to be negatively correlated with the number of bark-eating caterpillars. In recent years, the subtropical climate has seen a comparatively high rate of this bug (Haseeb, M., 2002). Different management strategies for this pest were also devised by various employees, but there is little research on the effectiveness of botanicals and entomopathogenic fungi in controlling bark eating caterpillars on mulberry leaves and fruits. Therefore, this research was conducted in the field to compare various management techniques against mulberry leaf and fruit bark eating defoliator caterpillars.

## MATERIALS AND METHODS

The research took place at the mulberry garden's experimental farm in the Mirzapur area. The study focused on the 10-year-old mulberry leaf and fruit trees of the Mirzapur district cv. With 15 therapies repeated three times, the experiment was carried out using a randomized block design. The treatments were, namely: T1- dichlorvos (5 ml/L) + Sealercum healer (s/h) + copper oxychloride (3 g/L) (COC) swabbing on the trunk; T2- chlorpyrifos (2 ml/L) swabbing on the trunk; T3- profenophos (2 ml/L) swabbing on the trunk; T4- dichlorvos (5 ml/L) + COC (3 g/L) swabbing on the trunk; T5- acephate (2 g/L) swabbing on the trunk; T6- chlorpyrifos (2 ml/L) + s/h + COC (3 g/L) swabbing on the trunk; T7- profenophos (2 ml/L) + s/h + COC (3 g/L) swabbing on the trunk; T8- dichlorvos alone; T9- sealercum healer alone; T10- swabbing COC (3g/L) alone on the trunk; T11- swabbing pine oil alone on the trunk; T12- swabbing linseed oil (3ml/L) + neem oil (5ml/L) on the trunk; T13- neem oil (5ml/L) alone; T14- swabbing entomopathogenic fungi *Beauveria bassiana* ( $2 \times 10^8$  @5g/L) on the trunk; and T15 – the Control. The

therapies were enforced in the final week of October 2015, when the highest prevalence of the pest was recorded. The observations were made 30, 45, and 60 days after the treatments, as well as prior to their application. At each interval, the number of ribbons produced by the caterpillar on the mulberry leaf and fruits trunk was visually counted and noted. To prevent any misunderstanding between old and fresh ribbon formation, the ribbons that formed on the trunk after each observation were manually destroyed. Treatment means were compared by Tukey's honesty test, and the data underwent analysis of variance.

## RESULTS AND DISCUSSION

At 30 days following the treatment, the impact of the various treatments on the incidence of mulberry leaf and fruits bark eating caterpillars was substantially different. The therapy in which profenophos was swabbed on the trunk had the least ribbon production by the caterpillar (0.53 ribbons/tree), followed by chlorpyriphos and acephate, with an average ribbon production of 0.87 ribbons per tree. The results are consistent with earlier research on organophosphate insecticides such demetonmethyl, quinalphos, and monocrotophos (Singh, et. al., 1988; Mote and Tambe, 1990; Patil and Deshpande, 1990; Verghese and Jayanthi, 2001).

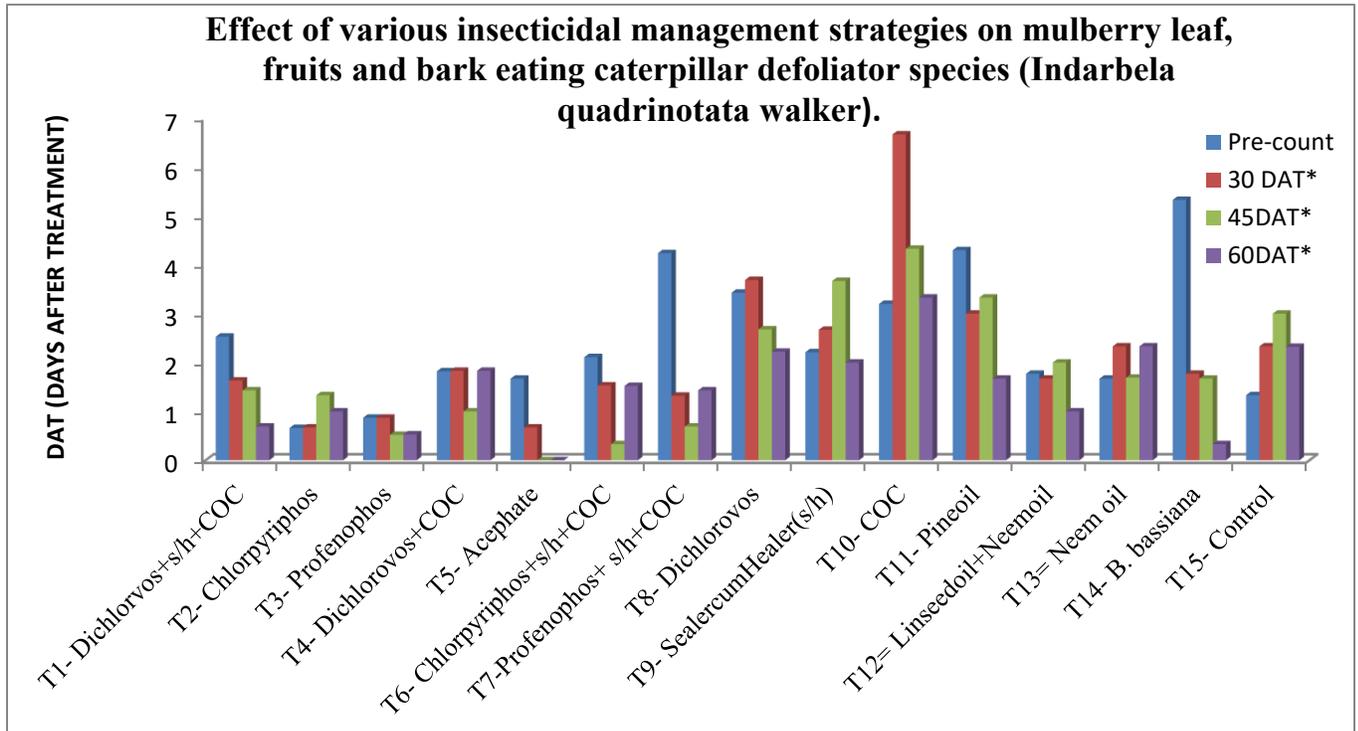
**Table1: Effect of various insecticidal management strategies on mulberry leaf, fruits and bark eating caterpillar defoliator species (*Indarbela quadrinotata* walker).**

Treatments of insecticides	Mean number of new ribbons formed mulberry tree <sup>-1</sup>			
	Pre-count	30 DAT*	45DAT*	60DAT*
<b>T1- Dichlorvos+s/h+COC</b>	2.53±0.88	1.63±0.33	1.43±0.00	0.69±0.33
<b>T2- Chlorpyriphos</b>	0.66±0.67	0.67±0.33	1.33±0.33	1.00±0.00
<b>T3- Profenophos</b>	0.87±0.67	0.87±0.53	0.52±0.43	0.53±0.43
<b>T4- Dichlorvos+COC</b>	1.82±0.88	1.83±0.88	1.00±0.58	1.83±0.88
<b>T5- Acephate</b>	1.67±1.20	0.67±0.67	0.00±0.00	0.00±0.00
<b>T6- Chlorpyriphos+s/h+COC</b>	2.11±0.58	1.53±0.67	0.33±0.33	1.52±0.33
<b>T7-Profenophos+ s/h+COC</b>	4.24±0.00	1.32±0.00	0.69±0.33	1.43±0.33
<b>T8- Dichlorvos</b>	3.43±1.33	3.69±2.73	2.68±1.76	2.22±0.58
<b>T9- SealerCumHealer(s/h)</b>	2.21±1.45	2.67±1.20	3.67±0.33	2.00±0.58
<b>T10- COC</b>	3.20±1.00	6.67±0.33	4.33±1.20	3.33±0.88
<b>T11- Pineoil</b>	4.30±2.08	3.00±1.73	3.33±1.76	1.67±0.33
<b>T12= Linseed oil + Neem oil</b>	1.77±1.20	1.67±1.20	2.00±1.00	1.00±0.58
<b>T13= Neem oil</b>	1.67±0.33	2.33±0.33	1.69±0.33	2.33±0.33
<b>T14- <i>B. bassiana</i></b>	5.33±2.08	1.77±0.67	1.67±1.20	0.33±0.33
<b>T15- Control</b>	1.33±0.33	2.33±0.88	3.00±0.58	2.32±0.88
<b>F</b>	1.47NS	2.44*	2.43*	3.08**

\*DAT-Days after treatment.

The remarkable difference in the incidence rate of the bark-eating caterpillar was seen after 45 days of treatment. Following profenophos and chlorpyriphos+s/h+COC with 0.33 ribbon formation per tree, there was no occurrence of bark-eating caterpillar on the acephate-treated trunk. The bark eating caterpillar infestation was significantly reduced by dichlorvos (0.5%),

copper oxychloride (3%), and s/h (IIHR product) (**Anonymous, 2013**). The Acephate trunk swab treatment, which was followed by *Beauveria bassiana* and profenophos, is superior to other therapies 60 days after the treatment.



**Fig: Represent the effect of various insecticidal management strategies on mulberry leaf, fruits and bark eating caterpillar defoliator species (*Indarbela quadrinotata walker*).**

The conclusions are consistent with those of (**Srivastava, A.S., 1964**) and they stated that *Beauveria bassiana*, an entomogenous fungus, eradicated the caterpillars and offers organic pest management in mulberry leaf and fruits mulberry gardens. Scale insects and mealy bugs are more prevalent in south India, and the tea mosquito bug, *Helopeltis antonii* (Signoret), is more prevalent in central India, while the bark eating caterpillar and fruit flies are widespread (**Butani, D.K.,1977a**). Nevertheless, recent research has shed light on some of the crucial details regarding the incidence and status of insect pests on this crop. Intensive surveys of mulberry leaf and fruit growing areas of Uttar Pradesh showed a rise in the incidence of the fruit borer, *Deudorix isocrates* (Fab), from 2.5 to 22.5%, with a crop loss rate between 5.00 and 35.00%. Also observed was the frequent presence of another fruit borer, *Dichocrocis punctiferalis* (Guenee), in mulberry leaves and fruits during the rainy season (**Mathur, Y.K., 1979 & Satyanarayan, C., 2013**). A major limiting factor in the output of mulberry leaves and fruits during the rainy season has been fruit flies. Fruit fly infestation ranged from 20.00 to 46.00 percent, resulting in crop losses of 16.00 to 40.00 percent, which is cause for alarm. The leaves, shoots, and fruits of the majority of the orchards inspected were also infested with scale insects, aphids, and mealybugs; however, the presence of their natural predators kept these insects under control. Only a small number of the thousand different insect pest species that have been

documented on mulberry leaves and fruits have been identified as pests that regularly occur and inflict significant harm. The fruit fly (*Bactrocera* spp.), scale insect (*Chloropulvinaria psidii*), and bark-eating caterpillar (*Indarbela* spp.) are examples of these. The area saw the first recorded occurrence of mites and shoot borers. The proliferation of these pests is caused by the drying and death of infected leaves and branches, which has a detrimental effect on plant development, flowering, and fruit production (**Singh, A.P., 2004**). It is imperative that these insects be identified and thoroughly investigated. In India, the two recently imported insect pests that require particular attention are the stem borer, *Aristobia testudo* (Voet), which is found in the northeast, and the spiraling white fly, *Aleurodicus dispersus* (Russel), which is found in the south. To prevent the introduction and spread of invasive pests, strict quarantine regulations and monitoring of the development of these insect pests are necessary. The naturalist uses mulberry fruit cluster of tight catkin flower suspension applications.

## CONCLUSION

A polyphagous pest in Bihar that eats bark is the caterpillar (*Indorbela* spp.). This insect was regarded as a severe threat to mango, mulberry leaf and fruit, litchi, and jamun trees. Because it is a wood borer, specific conditions are necessary for it to become established. Age of the tree is one of the most important factors, since this insect can multiply far more quickly in older trees than in younger ones. Due to its hidden habits, this insect has a greater chance of surviving once it has established itself inside a tree thanks to its biological features. A higher percentage of pests occurs in the neglected and filthy mulberry leaf and fruit garden than in the well-maintained and clean garden. As a result, when its attack is detected, it may be stopped by using the proper insecticides. Because the establishment of this insect generally occurs when the trees are still older and neglected, regular orchard inspection is essential to identify the infestation at its onset. Dichlorvos, Indoxacarb, Rynaxypyr, Chlorpyrifos, Deltamethrin, and Lambda cyhalothrin are the chemical pesticides advised for controlling it. To control this pest, it may be sufficient to apply any of the chemical insecticides listed above using a rocker sprayer to saturate the active holes, sleeve, and surrounding bark. Because the larvae can become infected and die when they feed on the bark around the sleeve. The environment is not much polluted because the chemical insecticides are only used to treat the bark. Additionally, the potential negative impacts on non-target species are reduced by using chemical insecticides as spot treatments. Since the spray needs to be applied only to the infected areas, this will also be cost-effective. The annual generations of *Indarbela* spp. start in June and July. From February forward, the pupation process begins throughout the roughly 10-month larval period. Consequently, it is best to apply chemical insecticides right away after the rains, preferably during the months of September and October, when the infestation is simple to identify. In younger mulberry trees, the treatment may be far more effective and cost-effective than in older trees, where the height of the trees may make it difficult to apply pesticides. The study comes to the conclusion that the best management strategy for preventing mulberry leaf and fruit bark eating caterpillars is to treat the mulberry leaf and fruit stem with acephate or entomo pathogenic fungus *B. bassiana*. The current study addresses the insect pests documented on mulberry leaves and fruits, as well as a thorough analysis of key ones for improving the productivity of silk thread and cocoons among sericulturist rearers.

## ACKNOWLEDGEMENT

I have incredible joy and advantage in communicating my profound feeling of appreciation and true respect to the most powerful individual in my postgraduate vocation, my companion's guide and my folks.

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