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Impact of Pesticides on Muga Silkworm Culture

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INTRODUCTION

Assam is ungrudgingly blessed with an abundance of scenic beauty, treasures of rare and near-extinct flora and fauna, and ample resources of minerals and oils. Its rich bio-diversity boasts of being home to many endangered species of wildlife such as the one-horned Rhino, Pygmy Hog, Hoolock gibbon, etc. among these bio-resources, a rare and unique bio-resource to behold is the golden silk which is produced by Muga silkworm, *Antherea assamensis* Helf. (Family:Saturniidae) polyphagous, multivoltine and semi-domesticated, species holds a special place in its cultural heritage and economy. This pride of Assam with high aesthetic value is the state's first product to get the Geographical Indication tag in 2007. Assam is the monopoly of Muga silk production globally and contributing to around 66% of India's production, Muga silkworm rearing enables thousands of rural population in becoming self-sufficient. Statistical data shows that Muga rearing provides livelihood to about 30,164 rural Assamese households. Muga silk known for its resilience, extreme durability, and natural shimmer, and glossy texture is thus an integral part of the rich culture and tradition of the Assamese people.

The semi-domestic outdoor nature of Muga silkworm hinders the prospects of good crop yield as several biotic and abiotic environmental factors act as a deterrent. Environmental pollutants, such as pesticides have been found detrimental to different life forms, silkworms being no exception especially Muga silkworm a sensitive organism is vulnerable to changing biotic and abiotic factors causing a paramount effect on its developmental stage. Silkworms are highly susceptible to pesticides and therefore application of pesticides in sericulture field is not at all advisable as the leaves of host plants are directly consumed by the silkworms and any exposure even in minute doses either through consumption of contaminated food or contact toxicity of the pesticides affects the growth, reproduction, eclosion, fecundity, and economic characteristics of cocoon.

Much as silkworm food plantations are free of agrochemicals, the application of pesticides near sericulture fields can cause harm to the silkworm. It is a known truth that complete elimination of eradication of pesticide drift is impossible. Pesticide toxicity is possible to float at a distance of 700 meters from sites of application of tea gardens to silkworm rearing fields. Often it is through pesticides sprayed in neighbouring areas that the sericulture fields are contaminated. Pesticide drift is one of the culprits for this indirect chemical pollution. The Brahmaputra Valley of Assam is famous for its lush tea gardens and more often, it is seen that the non-mulberry sericulture plantation fields and Som (*Persea bombycina*), the primary food plants of muga silkworms are located close to crop fields like paddy field and tea garden, thus leading to indirect contamination.

Pairing of Muga Moths

Rearing of Muga silkworm

The use of pesticides in the tea gardens as well as in agricultural crops is harmful to different stages of Muga silkworm. Spraying of plant protection formulations/pesticides in tea gardens leads to Muga silkworm showing various harmful effects such as loss of appetite, sluggishness, vomiting gut juices, lethargy, inactivity, change in colour mainly to black and eventual death sometimes. The effects were found to occur after 24-72 hours of pesticides application. Out of the major classes of synthetic pesticides, organophosphates and pyrethroides are in common use by farmers against pests of paddy and vegetables. Some pesticides are applied to manage Muga silkworm pests such as the synthetic pyrethroid, deltamethrin (Decis) which is effective in controlling the Uzi fly (*Exorista sorbillans)* silkworm parasitoid, with LC50 value at 0.106% but is also found to be highly toxic to Muga silkworm larvae with $LC50=9x10^{-5}$. Celeron, mitigate, profex, rocket, deltamethrin, thiomethoxam, propagite, fenpyroxymet, quinalphos, phosalone, ennova, acetamiprid, atom, omite, instant, profex super and profenofos are some commonly used pesticides in tea gardens where instant is observed to be the most lethal whose dose as low as 0.001% can kill 5^{th} stage larvae of *A. assamensis* within 2 hours while

organophosphates like malathion, phosphamidon and dimethoate are also highly toxic to the silkworm larvae even at infectious dosage. Malathion is found to be a feeding deterrent and interferes with the digestive physiology of the silkworm and in advanced stages, the pupation percentage and moth emergence percentage also decrease even at a lower concentration, although at the lowest dose it did not affect mean daily consumption, utilization and mean larval weight which only they decreased at increases dosages. Treatment with phosphamidon is reported to affect daily food intake and its utilization in Muga silkworm. The malathion and phosphamidon have a great effect on decreased in tissue weight along with total lipid, glycogen in females, and cholesterol in late instar male Muga silkworm. The pesticides atom, ennova, and instant have pronounced effects on cocoon parameters like cocoon weight, shell weight and fecundity.

The pesticide poisoning causes various detrimental effects in Muga silkworm depending on kinds and quantity of pesticides. It has been recorded that mild cases of pesticide poisoning for instance hamper the body weight by decreasing food consumption rate while in severe cases it proves destructive. Any alteration in its growth and development affects cocoon production and ultimately the economic benefit earned. It has been seen in recent times numerous reports on losses in Muga crops due to pesticide application. Muga silk industry, thus, unfortunately, looks into a bleak future with reports of facing extinction in the next few decades. This calls for a consensus approach among the stakeholders to adopt an integrated pest management system. Using pesticides judiciously, proper scheduling of pesticide application taking into consideration the sericulture activities in the vicinity of tea gardens/agricultural fields may help in mitigating the problem. Another way maybe is to search for highly selective, eco-friendly, and newer biodegradable pesticides for pest management or development of resistance in Muga silkworm against commonly used chemical pesticides. An important bio-resource of Assam is at stake and if timely measures are not taken this pride of Assam may be lost forever.

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