Plant Archives Vol. 24, Special Issue (VS), 2024 pp.134-137 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.specialissue.021

RESEARCH ON VIROSIS MANAGEMENT IN TROPICAL TASAR SILKWORMS: A TIME TRAVEL

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ABSTRACT

The impact of virosis on tasar silk production remains a significant concern. However, research on controlling virosis in tasar silkworms has made commendable progress. The Central Tasar Research and Training Institute (CTR&TI) has played a pivotal role in addressing this issue, particularly in finding solutions to control AmCPV (*Antheraea mylitta* Cytoplasmic Polyhedrosis Virus). Unlike viral diseases in other silk worms, virosis in tasar silkworms is majorly caused by a cypovirus belonging to the Reoviridae family. Efforts to manage AmCPV started with the use of disinfectants like formalin, bleaching powder, and slaked lime, as well as natural alternatives such as wood ash. Studies have also explored the antiviral activity of sodium hypochlorite and the development of attenuated virus-based vaccines, which have shown promising results in reducing silkworm mortality. Botanical formulation, due to its environmentally friendly nature, have emerged as safe alternatives for virosis control. Continued research and collaborative efforts are crucial for further advancements in protecting tasar silk production from the detrimental effects of virosis.

Key words: AmCPV, Tasar silkworm, cypovirus, virosis management

Introduction

The economic impact of virosis on tasar silk production is alarming, causing 25-30% loss (Sahay *et al*, 2000). However, research progress in controlling virosis in tasar silkworms has shown commendable improvement over time. The significant contributions made by the Central Tasar Research and Training Institute (CTR&TI) towards finding effective solutions to control AmCPV (*Antheraea mylitta* Cytoplasmic Polyhedrosis Virus) play a pivotal role in addressing this pressing issue. Unlike viral diseases in other silk worms, virosis in tropical tasar silkworm (*Antheraea mylitta*) is caused by a cypovirus belongs to Reoviridae family, generally called as, cytoplasmic polyhedrosis virus (AmCPV). AmCPV is a double stranded RNA virus contains 11 segments in its genome (Chakrabarti *et al*., 2010). The virus causes cytoplasmic polyhedrosis, a disease that affects the midgut of the silkworm larvae. The infection of AmCPV in the tasar silkworm larvae leads to a disease known as tasar grasserie, which causes high mortality rates in the larvae. The virus spreads through contact between infected and healthy larvae or via contaminated food. AmCPV poses a serious threat to the tasar silk industry, as it can lead to significant economic losses. Efforts are underway to manage and control the spread of this virus to safeguard the tasar silk industry.

AmCPV affected larvae (left) versus healthy Larvae (right)

Controlling Virosis in Tropical Tasar Silkworms: Progress and Solutions

Singh *et al*. (2005) studied the effects of various disinfectants namely slaked lime, formalin and bleaching powder on AmCPV. His reports reveal that, though all the three disinfectants found to reduce infection certain concentrations resulted complete inactivation. Formalin was effective when applied at 2% concentration for 30 minutes. Whereas, bleaching powder and slaked lime were effective when applied at 4% and 0.4% respectively with an exposure duration of 20 minutes. A year after this report, Singh *et al.* reported antiviral activity of wood ashes on AmCPV. He used wood ashes from *Terminalia arjuna* (arjun) and *T. tomentosa* (asan) for their ability to curb AmCPV from establishing infection on *A. mylitta*. The Polyhedral Occlusion Bodies (POD) were exposed to varied concentrations of wood ash ranges from 0.5% to 4%. The study revealed that, wood ash has a significant impact on virulence of AmCPV. Polyhedral bodies were completely dissolved after exposure to 2% wood ash for 20-30 minutes. However, exposure of AmCPV to wood ash for a short duration did not reduce the mortality of tasar silkworm (Singh *et al*., 2006).

Sodium hypochlorite is viewed as an effective control measure for virsis till date. This was reported by Sahay *et al.* (2008). The study demonstrated that, 0.1% NaoCl is most effective in controlling AmCPV.

A few years later, Singh *et al*. for the first time, explored the possibilities of attenuated virus in controlling AmCPV infection. The virus was attenuated using formalin and sodium carbonate and confirmed for its no infectivity on tasar silkworm. Further, the attenuated virus was used as an oral vaccine by introducing them orally along with the leaves. The findings indicated that administering triple vaccination at an increased dosage exhibited notable effectiveness, resulting in a reduction of silkworm mortality by up to 80%. This vaccination approach proved particularly efficacious when administered 24 hours before the onset of the infection cycle (Singh *et al*., 2011).

A research journey with botanicals

Botanical formulations present environmentally friendly and safe alternatives when contrasted with chemical formulations. They are the naturally existing, widely accepted options since it is safe to human beings as well as environment. It is being extensively researched for diverse applications, ranging from medicinal uses to pest control. Singh *et al*. (2008) delved into investigating the impact of phyto-extracts on reducing larval mortality caused by virosis. Their study specifically highlighted the effectiveness of *Eclipta alba*, commonly known as false daisy or bhringraj, in this regard. The research indicates that *E. alba* demonstrated promising results in mitigating larval mortality attributed to virosis. Singh *et al.* (2010) again studied ten plant extracts based on mortality reduction, namely *Azadirichita indica* (neem), *Psoralea corylifolia*, *Acharanthus aspera*, *Asparagus racemosus*, *Andrographis paniculata* (Kalmegh), *Adhatoda zelanica* (Basak), whole plant of *Phyllanthus urinaria* (Bhuiamla), *Moringa oilephera* (sahjan), *Centella asiatica* (Veng sag) and *Curcuma longa* (Haldi powder). Mortality due to virosis was lesser in larvae fed with *P. urinaria*, followed by *A. paniculata*. Kumar *et al*. (2012) screened phytoextracts of various medicinal plants for their antiviral activity against AmCPV based on reduction in mortality and haemocyte count. Among the thirteen phytoextracts tested, two percent aqueous extracts of *Psoralea coryleifolia, Aloe barbedensis* and *Bougainvillea spectabilis* were efficient and reduced larval mortality due to AmCPV virosis.

Singh *et al.* (2015) prepared a botanical formulation using *Andrographis paniculata*, *Phyllanthus niruri*, *Aloe vera* and studied its impact on virosis in tasar silkworm. The formulation at 2.5% reduced the larval moratlity of AmCPV infected *A. mylitta*. A botanical formulation, namely Jeevan Sudha, developed from CTRTI is widely in use for controlling AmCPV infection in tasar silkworm.

Kumar et al. (2015) conducted a study examining the efficacy of different chemicals—Sodium Silicate Pentahydrate (SSP), Benzalkonium Chloride (BKC), Tri-sodium Orthophosphate (TSP) and Didecyldimethylammonium Chloride (DDC)—in managing silkworm diseases. Their findings revealed that TSP demonstrated the most significant reduction in virosis, with a percentile score of 94.90, followed by DDC at 72.45.

Study	Findings
Singh *et al*. (2005)	Studied the effects of various disinfectants: slaked lime, formalin, and bleaching powder, on AmCPV. Formalin is effective at a 2% concentration for 30 minutes. Bleaching powder and slaked lime were effective at 4% and 0.4%, respectively, with an exposure duration of 20 minutes.
Singh *et al*. (2006)	Wood ash at 2% concentration for 20-30 minutes were effective against AmCPV
Sahay *et al*. (2008)	Sodium hypochlorite (0.1% NaOCl) is the most effective in controlling AmCPV.
Singh *et al.* (2011)	Attenuated virus for control of virosis. Effective when administered 24 hours before the onset of the infection cycle.
Singh *et al.* (2008)	Investigation of the impact of phyto-extracts on reducing larval mortality caused by virosis. Specifically highlighted the effectiveness of *Eclipta alba*.
Singh *et al.* (2010)	Study of ten plant extracts based on mortality reduction. Mortality due to virosis was lesser in larvae fed with *Phyllanthus urinaria*, followed by *Andrographis paniculata*.
Kumar *et al*. (2012)	Screening of phytoextracts of various medicinal plants for their antiviral activity against AmCPV. Two percent aqueous extracts of *Psoralea coryleifolia*, *Aloe barbedensis*, and *Bougainvillea spectabilis* were efficient and reduced larval mortality due to AmCPV virosis.
Singh *et al.* (2015)	Preparation of a botanical formulation using *Andrographis paniculata*, *Phyllanthus niruri*, *Aloe vera*, and studying its impact on virosis in tasar silkworm. The formulation at 2.5% reduced the larval mortality of AmCPV-infected *A. mylitta*.
Kumar *et al.* (2015)	Examined the efficacy of different chemicals in managing silkworm diseases. Tri-sodium Orthophosphate (TSP) showed most significant reduction in virosis, with a percentile score of 94.90.

Conclusion

In conclusion, the economic impact of virosis on tasar silk production remains a significant concern, causing substantial losses ranging from 25-30%. However, research efforts in controlling virosis in tasar silkworms have shown commendable progress over time. The contributions of institutions like the Central Tasar Research and Training Institute (CTR&TI) have been pivotal in addressing this pressing issue, particularly in finding effective solutions to control AmCPV. Various approaches have been explored, including the use of disinfectants such as formalin, bleaching powder, and slaked lime, as well as natural alternatives like wood ash and botanical formulations. Additionally, studies on the antiviral activity of sodium hypochlorite and the development of attenuated virus-based vaccines have shown promising results in reducing silkworm mortality. Moreover, botanical formulations, owing to their environmentally friendly nature, have emerged as safe alternatives for virosis control. Continued research and collaborative efforts in this field are crucial for further advancements in protecting tasar silk production from the detrimental effects of virosis.

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