GreenariA
Go Green, Learn Green
An Agricultural Monthly e-Magazine
Volume 02, Issue 04, 2024
ISSN: 2584-153X
Article ID: G-24-0401

Epiricania melanoleuca - A POTENT NATURAL ENEMY OF *Pyrilla Perpusilla*

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INTRODUCTION

Sugarcane (*Saccharum officinarum*), a vital crop in the Indian sub-continent, fuels the sugar industry, contributing over 62% to global sugar production. Apart from being a source of sucrose, sugarcane offers various by-products, making it an essential agro-based industry. Globally, India stands as the second-largest producer of sugarcane, generating an impressive yield of 60-70 tons per hectare, following closely behind Brazil. The global landscape includes cane-growing countries like Cuba, China, Pakistan, Mexico, South Africa, and Australia. In the case of sugar production and consumption India emerges as the leading producer and second largest in exporting. However, the industry faces a significant threat from the Sugarcane Leaf hopper (*Pyrilla perpusilla*) an endemic pest, which results in a reduction in its production as well as leading to potential yield losses of up to 40%. With multiple generations per year, the pest remains active from plantation to harvesting, impacting sucrose percentage, plant health, and overall yield. Its insidious presence extends to various crops, such as wheat, sorghum, rice, mango, oats, and barley. In this agricultural landscape, the parasitoid *Epiricania* (*Fulgoraecia*) *melanoleuca* emerges as a hopeful ally, contributing to sustainable sugarcane cultivation by controlling the threat of *Pyrilla perpusilla*.

Pyrilla perpusilla - A BANE TO SUGARCANE CULTIVATION

Pyrilla perpusilla, commonly known as the Sugarcane Leaf hopper in the family Lophopidae. It is native to Asia, a prominent pest in sugarcane growing areas with a yellowish-brown colored soft-bodied insect with having elongated snout with piercing and sucking type of mouthparts which tremendously reduces production and sucrose content in canes.

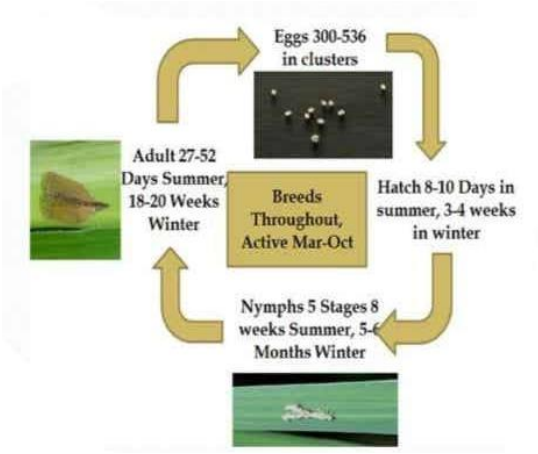
Both the nymph and adult stages feed on sugarcane causing economic damage to the crop. The Early infestation that occurs during the cane's grand growth period can negatively affect the yield. The late infestation mainly results in the cane's sucrose content.

Pyrilla perpusilla sustains itself by extracting sap, primarily from the leaf's underside, resulting in serious weakness to the host plant. It also results in severe drying of leaves, and stunted growth, and the sucrose percentage in the juice diminishes, adversely affecting sugar production. Additionally, the Leaf hopper excretes honeydew, fostering the growth of a black fungus that impedes photosynthesis and further reduces yield.

LIFE CYCLE AND HABITS

Pyrilla perpusilla, exhibits a life cycle intricately linked with the sugarcane plant. Its straw-colored adult form, with two pairs of wings folded like a roof on its back, lays approximately 600-800 pale greenish-yellow eggs on the underside of leaves. Covered with a white filamentous waxy material secreted by the female, these eggs hatch in 7-10 days during summer.

The newly hatched nymphs are milky white, with characteristic processes or filaments covered by wax. Active and numerous, these nymphs pose a significant threat, particularly during the sugarcane's vulnerable stages. The nymphal period lasts one to two months, completing the life cycle in about two months with 3-4 generations in a year.



SWARMS AND ENVIRONMENTAL DYNAMICS

The insect's activity is not confined to a specific season, remaining active from plantation to harvesting. Favorable conditions, such as a mild winter followed by a temperate summer with periodic showers, create an environment conducive to the survival and proliferation of *Pyrilla perpusilla*. Conversely, factors like a monsoon failure, overcast weather, and delayed action by natural predators can expedite the pest's multiplication.

GLIMPSE Of *Epiricania melanoleuca*

Epiricania melanoleuca, a moth species belonging to the family Epipyropidae, emerges as a silent guardian in the agricultural landscape, particularly in the sugarcane fields of India. Described by Thomas Bainbrigge Fletcher in 1939, this unassuming moth plays a pivotal role as an external parasitoid of the notorious sugarcane planthopper, *Pyrilla perpusilla*. Native to the drier regions of the sugarcane-growing areas in India, and extending its influence to Pakistan and Bangladesh, *Epiricania melanoleuca* has earned its stripes as an effective biological control agent against a significant agricultural pest.

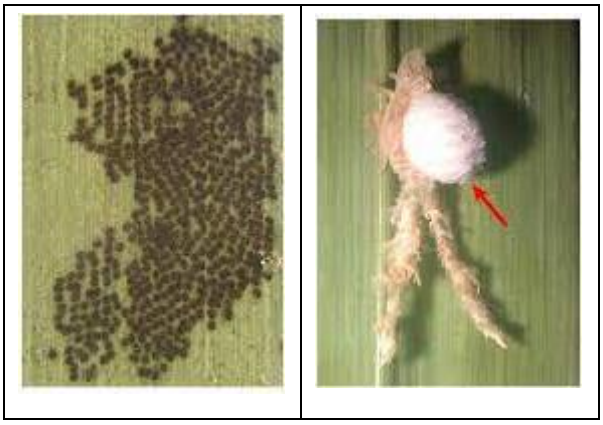
TAXONOMY AND EVOLUTION

The fascinating world of parasitoids unfolds in the taxonomy of *Epiricana*

melanoluca, previously known as *Fulgoraecia melanoleuca*. This Lepidopteran wonder belongs to the order Lepidoptera and has undergone nomenclatural shifts, initially classified by Fletcher as *Epipyrops melanoleuca* in India. Notably, the genus Epipyrops was later reassigned to Epiricania, marking the insect as *Epiricania Melanoleuca* (Fletcher). The saga continued as per the Lepindex, leading to a renaming as *Fulgoraecia Melanoleuca* (Fletcher). This intricate taxonomic history underscores its rich evolution within the parasitoid family.

MORPHOLOGY AND BIOLOGY

The morphology and biology of *Epiricana melanoluca* have been meticulously detailed by researchers, building upon Fletcher's pioneering work. Both genders exhibit distinct features. Male adults display off-white forewings and hind wings, while females showcase grey-black forewings and dark grey hind wings. Not merely an aesthetic distinction, these features play a role in their interactions and reproductive activities. Bi-pectinate antennae are a shared characteristic. Females, immediately after emergence, initiate egg-laying, depositing between 234 to 450 light brown eggs primarily on leaf margins, near their cocoons.



The larval stage is a critical chapter, where the larvae, displaying a proboscis-like structure, adeptly feed on the host *Pyrilla Perpusllla*'s abdominal fluids. With four pairs of abdominal and one pair of anal prolegs, adorned with white waxy material, these larvae undergo three instars on the host. Detachment from the host precedes pupation on the leaf's surface near the ground. With a life cycle marked by diapause lasting 8-10 months under adverse conditions, these parasitoid exhibits remarkable adaptability. The life cycle culminates in the emergence of adult males, distinguished by their active flight in search of females for coupling. The coupling period under field conditions lasts 10 to 15 minutes, marking a brief yet vital phase in their reproductive journey.

Female

Male

Mass production of *Epiricana melanoluca:*

Production Procedure:

The process begins with collecting pupae from fields, fostering their emergence in petri dishes, and facilitating mating among

adults. Female moths are then allowed to lay eggs on cardboard pieces, which are carefully incubated until hatching in glass vials at an optimal temperature range of 26-34 °C.

Parasitization Process:

A pivotal phase in the life cycle is parasitization. Third instar Pyrilla nymphs from the field become hosts, with one parasitoid introduced for every two nymphs during a 15-20 minute exposure. This precise orchestration ensures successful parasitization, setting the stage for the subsequent life cycle.

Field Deployment for Continued Life Cycle:

Parasitized nymphs,now carrying the next generation of *Epiricana melanoluca*, are released onto sugarcane clumps. These clumps are covered with breeding cages, constructed with wooden frames and plastic mesh, creating a controlled environment for the parasitoids to continue their life cycle with an ample supply of Pyrilla hosts.

Scaling Up - Ensuring Adequate Hosts:

To encourage the *Epiricana melanoluca* population, about 300 egg masses, each with sugarcane leaves, are strategically placed in the field. Individual meshed cages cover these masses, providing isolated environments conducive to the development of the parasitoid. Introducing Pyrilla populations fosters the growth of the parasitoid community, ensuring a robust population.

Alternative Rearing Methodology:

While the glass jar method is effective, a scalable approach involves using wooden cages. These larger cages, measuring 45 × 45 × 65 cm, replicate the conditions of the glass jars but on a grander scale. Sterilized moist sand, leaves, and the release technique mirror those of the glass jar method, enabling large-scale rearing for over 10,000 eggs daily for field release.

Why *Epiricana melanoluca* as a "Biological Warrior"?

The strategic use of *Epiricana melanoluca* in biological control against *Pyrilla perpusilla* hinges on several unique attributes:

1. High Egg-Laying Capacity: *Epiricana melanoluca* boasts a superior egg-laying capacity compared to its host, Pyrilla.

2. Short Life Cycle: The parasitoid's swift life cycle outpaces that of its natural host.

3. Lepidopteran Parasitoid: As a member of the Lepidoptera order, it provides a natural balance in ecosystems.

4. Effective Searching Capacity: Neonate larvae exhibit a heightened searching capacity, enhancing their predation efficiency.

5. Adaptability under Adverse Conditions: The eggs of *F. Melanoleuca* can endure diapause for 8-10 months under unfavorable conditions, showcasing remarkable resilience.

6. Synchronization with Pyrilla Population: There exists a striking synchronization between Pyrilla population peaks and the appearance of *Epiricana melanoluca*, a crucial factor for effective biocontrol.

7. Efficient Larval Attachment: Larvae possess circular crochets, ensuring a secure and lasting attachment to the host's body,

maximizing parasitization under field conditions.

Environmental Adaptability and Synchronization:

One of the standout features of *Epiricana melanoluca* is its remarkable adaptability under adverse climatic conditions. The eggs of this parasitoid can enter a diapause state, lasting 8-10 months, allowing it to endure unfavorable environmental conditions. This resilience adds to its effectiveness as a biological control agent, ensuring its availability when needed, especially during periods of Pyrilla infestation.

The synchronization between the population peaks of Pyrilla and the appearance of *Epiricana melanoluca* is a key ecological phenomenon. This synchronicity is pivotal for the success of biocontrol efforts. When Pyrilla populations surge, *Epiricana melanoluca* emerges, providing a timely and natural response to the increasing threat. This dynamic relationship underscores the intricate ecological balance maintained by these species in sugarcane ecosystems.

Research Insights - Weather Factors and Population Dynamics:

Scientific studies have been conducted to understand the complex relationship between weather factors and the population dynamics of *Pyrilla perpusilla* and its parasitoid *Epiricana melanoluca.* The studies involved field experiments aimed at determining the impact of maximum and minimum temperatures, relative humidity, and rainfall on the population of *Pyrilla perpusilla*.

The results revealed a significant positive correlation between the temperature (both maximum and minimum) and the population of Pyrilla eggs, nymphs, and adults. However, the relative humidity at specific hours showed varying correlations, indicating the complex interplay of environmental factors. These findings are crucial in predicting and managing Pyrilla infestations based on weather conditions, leading to more effective pest control strategies.

Eco-Friendly Pest Management - Silicon application:

In response to the pitfalls of chemical pesticides, a green alternative surfaces: silicon application. Research showcases silicon's dual role in enhancing plant resistance and beckoning beneficial predators. *Epiricana melanoluca*, a linchpin in natural pest control, reaps the benefits of this eco-friendly strategy. Embracing silicon as a catalyst, sugarcane ecosystems find a harmonious balance, mitigating the collateral damage wrought by conventional pesticides.

CONCLUSION

Epiricana melanoluca is a strong and sustainable guardian in the complex world of sugarcane ecosystems. Its role in biological pest control, adaptable nature, synchronization with Pyrilla populations, and contributions to scientific understanding make it a key player in the pursuit of sustainable agriculture. As the challenges of pest management continue to evolve, the importance of eco-friendly approaches, such as silicon application, becomes increasingly evident. *Epiricana melanoluca*, with its high egg-laying capacity, short life cycle, and adaptability, is a natural ally for farmers seeking effective and environmentally conscious solutions. In the ongoing story of agricultural practices, *Epiricana melanoluca* offers a compelling chapter, highlighting the delicate balance that can be achieved through

the integration of natural control mechanisms. Its presence not only reduces the threat of *Pyrilla perpusilla* but also emphasizes the potential for harmonious coexistence between agriculture and the surrounding ecosystem.