

Apefly *Spalgisepius* a potential predator for sugarcane crown mealybug management

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Abstract

The crown mealybug, *Phenacoccus saccharifolii* (Hemiptera: Pseudococcidae), a sap-sucking pest, has recently emerged as a serious threat to sugarcane and the sugar industry in several sugarcane-growing regions of southern India, particularly Tamil Nadu. The crown mealybug typically infests sugarcane crops at all stages, from young seedlings to mature canes, with a preference for plants aged 5 to 6 months. The severity of infestation is particularly high during the summer months (May to September) in all seasons. While insecticides have been employed to control the mealybug, their effectiveness is limited because the pest occurs deep within the inner crown region of the leaf whorl. Therefore, biological control is considered the most effective long-term solution to the mealybug infestations. Because the parasites and predators are self-perpetuating, they persist even when the mealybug is at low population densities, and they continue to attack the mealybugs, keeping populations below economic injury levels. In this study, we focused on the Lepidopteran predator, commonly known as the apefly, *Spalgisepius* (Lepidoptera: Lycaenidae), collected from the sugarcane fields as well as cassava fields infested by the mealybugs. We investigated its feeding potential under *in vitro* conditions to assess its feasibility as a biological control agent for managing the sugarcane crown mealybugs.

Keywords: Crown mealy bug, sugarcane, apefly, survey, mass culturing, pumpkin

Introduction

In India, the current area under sugarcane cultivation is estimated at 5.8 million hectares, with a productivity of 84 tonnes per hectare, which is lower than the productivity recorded in the previous years. Several factors have contributed to the recent decline in sugarcane productivity, including biotic, abiotic, and socio-economic factors. Among the biotic factors, insect pests play a significant role in reducing the yield potential of sugarcane. The crown mealybug infestation in the sugarcane fields was first observed in the Pugalur area of the Karur district, followed by a severe outbreak in the Sathamangalam, Ariyalur, and Erode districts of Tamil Nadu. In both young plants and mature canes, all stages of nymphs and adult female mealybugs feed on sap from the central culm, leaf whorls, and leaves. The affected plants had severe yellowing, sooty mould development, stunting, drying/rotting of the central whorl, failure to produce canes, profuse grassy tillering, as well as failure of establishment of sprouted ratoons. The varieties CoV 09356, Co 06022, CoG 6, Co 0210, CoV 92102, Co 11015, Co 09004 and Co 86032 grown across Tamil Nadu regions were severely infested by crown mealybug. The ratoon crop was more severely affected than the plant crop.



Crown mealybug affected field



Crown mealybug spread on the leafwhorl of sugarcane



Crown mealy bug freshly emerged crawlers and ovisac crown mealy bug Biology of crown mealybug



Potted plants severely affected by

Eggs: The posterior end of the female had long tubular ovisacs containing 300 to 500 loosely packed eggs. The eggs were laid in batches within the same ovisac, forming clusters. Freshly laid eggs were pale yellow and oval-shaped.

Nymphs and adults: The freshly emerged crawlers were yellow, highly active, and moved in groups. The matured nymphs were yellow, soft-bodied, and completely covered in a white, powdery waxy coating. The waxy filaments were prominent all around the body, with noticeable protrusions observed in males. Males undergo a true pupal stage, whereas females develop into adults without undergoing metamorphosis. The well-matured females were stout, inactive, and their whole bodies covered with white waxy filaments. The ovisac of females was more than twice the size of the body. The females often crowded together, with their overlapping long ovisacs forming a cotton-bed-like appearance. The long body of the adult female became globular, wide at the posterior end with waxy projections. The females suck the sap from the leaves, resulting in distinct black necrotic scars on the leaves.

Materials and Methods

Although various chemical insecticides are available, achieving complete control of crown mealybug remains difficult due to their hidden presence within the inner crown region of the leaf whorl. In this context, biological control is the only feasible alternative method to manage this notorious pest in sugarcane. Because predators and parasitoids are self-sustaining, species-specific, environmentally safe, have a low risk of resistance development, and can be easily augmented. One of the lepidopteran predators *Spalgisepius* (Lepidoptera: Lycaenidae), has emerged as a promising predator for controlling sugarcane crown mealybug. The genus *Spalgis* is recognized for its distinctive pupal stage, where the pupae resemble the appearance of a monkey's face, leading to its nickname, "Apefly." Larvae in the first to third instar stages were commonly found in most crown mealybug colonies and effectively preyed on eggs, first, second, and third instar mealybugs.

Results

Biology of *Spalgisepius*

Eggs: Eggs are laid singly within the ovisacs of mealybugs. Freshly laid eggs are smooth, disc-shaped, and greenish-blue in color, with a sculpted surface and flattened top and bottom, featuring a micropylar depression on the top. As they mature, the eggs gradually turn white before hatching. The incubation period ranges from 4 to 6 days.

Larva: The newly hatched larva is pale white with a dark brown head and fringed with fine white setae. The mature larva turns grey with a brown mid-dorsal line and is covered by a thick wax coating. Its setae are interwoven with debris from mealybugs. There were 4 larval instars, and the larval period lasts 9-12 days.

Pupa: The prepupal larva shrinks and changes to a dull black color, with most of its setae disappeared. The pupa is light brown on the dorso-lateral side and whitish-grey on the ventral side. The hardened dorsal surface resembles the face of a monkey, with distinct spots resembling eyes, a nose, and cheeks. These markings become progressively darker as growth advances. The pre pupal and pupal period ranged from 1-2 days and 8-11 days, respectively.

Adults: Spalgisepius adults are small butterflies. Males have dark brown forewings, while females have greyish-brown forewings. Both sexes have grey hindwings with dark striations. In males, the forewing features a prominent small quadrate spot at the cell end, whereas in females, this spot is larger and more diffuse. Male forewings are elongated with sharp apices, while female forewings are shorter and rounder. The lifespan of male adults ranges from 2 to 4 days, whereas females live for 4 to 6 days.



S. epius egg



Various instars of S. epius



S. epius prepupa



S. epius pupae

Mass production of Spalgisepiu



S. epius adults



Rearing croton mealybug on the pumpkin



Spalgis epius pupae on the pumpkin



Close up view of Spalgis epius pupae



Grown up larvae released on the guava leaves for pupation



S. epius adults released in the shade net house for oviposition

Croton mealybugs, *Planococcus citri* (Hemiptera: Pseudococcidae), were cultured on pumpkins to mass-produce for managing crown mealybugs, *Phenacoccus saccharifolii*. Infested pumpkins with mealybugs were placed in a 20 x 20-foot shade net house containing an Ashoka tree to facilitate mating. Ten pairs of adult *Spalgisepius* were collected from mealybug-infested cassava fields and released onto pumpkins cultured with croton mealybugs. A 10% honey solution was provided as adult food. During the exposure period, the females lay eggs singly in and around the mealybug ovisacs. The young larvae initially feed on eggs and small mealybugs, but as they mature, they become more voracious, consuming all stages of mealybugs. The mature larvae were collected and placed in separate boxes containing guava or croton leaves to pupate. The adult that emerged from the pupae were immediately collected, paired, and then released into fresh pumpkin cultured with croton mealybugs kept in the shade net house. The procedure was repeated to produce a sufficient quantity of *S. epius* for controlling crown mealybug.

Feeding potential of *Spalgisepius* against sugarcane crown mealybug *P. saccharifolii*

Our laboratory studies determined the feeding potential of *Spalgisepius* against the sugarcane crown mealybug *P. saccharifolii*. The first instar larva of *S. epius* was allowed to feed on first and second instar crown mealybug colonies infesting sugarcane leaf whorls. The number of first and second instar crown mealybugs in the sugarcane leaf whorl was recorded prior to feeding. The food was changed every alternate day till pupation. Finally, the total number of mealybugs (first and second instar) consumed by a single *S. epius* larva was determined. The fast-feeding and highly mobile larva consumes up to 550 mealybugs during its lifetime. Thus, *S. epius* serves as an effective predator for the biological control of mealybugs in sugarcane. Its use can reduce the reliance on chemical sprays and represents a valuable tool in integrated pest management and resistance management programs.

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