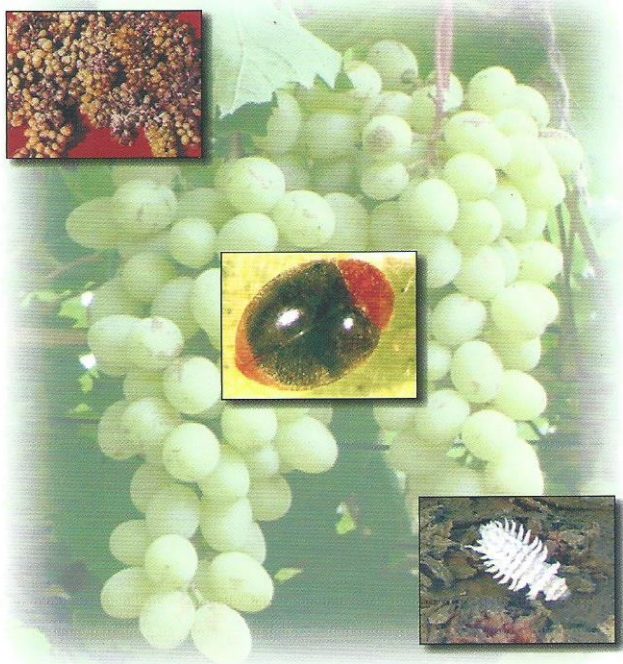


BIOLOGICAL CONTROL OF GRAPEVINE MEALYBUGS

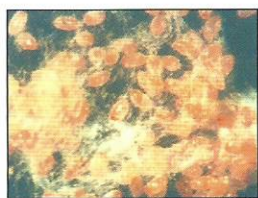


PROJECT DIRECTORATE OF
BIOLOGICAL CONTROL
BANGALORE

The pink mealybug- a major problem of grapevine:

Mealybugs are soft bodied insect pests attacking many fruit crops. They are called "hard-to-kill" pests of different fruit trees. The mealybug species, *Maconellicoccus hirsutus* is widely present on grapevine in peninsular India. It is commonly called the pink mealybug or grapevine mealybug as it is pink in colour and its main host is grapevine. In India, *M. hirsutus* is commonly found in many grape growing areas of Karnataka (Bangalore, Kolar, Bijapur, Chitradurga and Chikkamagalur), Maharashtra (Sangli, Solapur and Nasik), Andhra Pradesh (Hyderabad and Anantpur) and Tamil Nadu (North Arcot, Madurai, Coimbatore, Anna and Dharmapuri) on commercial varieties like Thompson Seedless, Anab-e-Shahi and Gulabi .

Mealybugs colonise all the parts of the plants. The greatest damage is done to the fruit bunches. Nymphs and adults of the



M. hirsutus eggs



Nymphs and adult of *M. hirsutus*

mealybugs suck sap and secrete honeydew which attracts sooty mould. The fruits with sooty mould and mealybugs lose market value. The quality of wine and raisins made from such grapes is inferior. The eggs of *M. hirsutus* are pink and are found in waxy ovisacs. The nymphs and females are pink and are sparsely covered with white wax. Each female deposits 300-500 eggs. These eggs hatch in 5 to 10 days depending on climatic conditions. A generation is usually completed in a month. The final instar nymphs, commonly called crawlers are the only mobile stages which find a suitable

place on the plants to settle, start sucking the sap and form a colony. The nymphs and adults are the damaging stages. The increasing mealybug population may be due to the indiscriminate use of pesticides. They are considered hard-to-kill pests on several counts. They form their colonies in protected areas like cracks and crevices and hidden places on the plant where pesticides may not reach. Apart from this, different stages of these pests are covered with waxy filaments and hence many pesticides have failed to check their populations. Use of pesticides can lead to several other problems like residual toxicity, resurgence of minor pests, development of resistance and environmental pollution.

Biological control: Mealybugs being sessile and less mobile are more amenable to biological control. Several predators and parasitoids have been recorded on *M. hirsutus*. Among



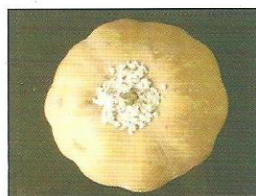
C. montrouzieri adult



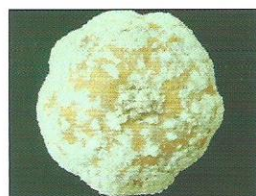
C. montrouzieri larva



Pumpkin with
ridges and grooves



Pumpkin infested with
mealybug ovisacs



Fully infested pumpkin



Release of beetles on
infested pumpkin

them, the larvae of the Australian ladybird beetle *Cryptolaemus montrouzieri* are known to be voracious, each consuming about 1000 eggs and 300 nymphs of *M. hirsutus*. Adults also feed on the mealybugs. It has given excellent control of the mealybugs on many fruit crops, hence it has been chosen as the best candidate against grapevine mealybug.

***Cryptolaemus montrouzieri*:** The beetles are dark brownish black with reddish head. It lays its pale yellow eggs among the colony of the mealybugs. A beetle can lay 200 to 220 eggs which hatch in 5 to 10 days. The viability of eggs is 90-100 per cent. The larva is gray in colour but is covered with white waxy filaments. The grub has four instars which are completed in 20 days. The pre-pupal period is 3-4 days and the pupal period lasts for around 8 days. The resulting adults can survive for 50 to 60 days. Male to female ratio is 1:1. The pre-mating and pre-oviposition periods are 5 and 10 days, respectively.

Multiplication techniques

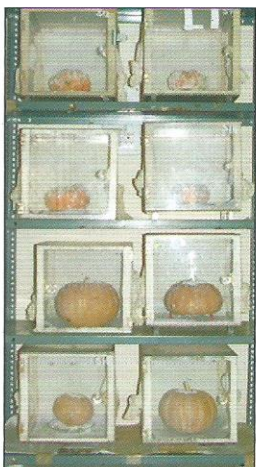
a. Host mealybug: Mass culture of mealybugs is essential for large scale production of their predators. For propagation of *C. montrouzieri*, either *Planococcus citri* or *M. hirsutus* can be used. The mealybugs are reared on ripe pumpkin with ridges and grooves. Grooves help in faster settlement of the crawlers. The pumpkins should have long and robust stalk to facilitate handling. The pumpkins are cleaned in water, the injuries sealed with molten wax and treated with fungicide to avoid fungal infections. Ovisacs of mealybugs are kept over the pumpkin around the stalk for about 48 hours. The infested pumpkins are kept on iron stands which are then placed in an acrylic cage of 30x30x30 cm size. The crawlers emerging from the ovisac settle on the pumpkin and multiply



Larvae multiplied on
mealybug infested pumpkin



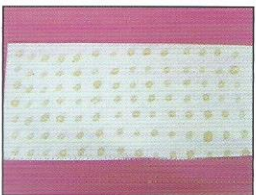
Larvae clearing mealybug
colony in field



Mass culturing of mealybugs
in the laboratory



Ingredients of
honey-agar medium



Honey-agar medium

in about 15 to 20 days. An assembly of infested pumpkin can be kept in iron racks. Fully infested pumpkins can either be used for predator multiplication or for further host (i.e. mealybug) rearing. Alternatively, potato sprouts can be used for mealybug multiplication.

b. The predator: After 15 days of infestation of pumpkin with mealybugs, they are exposed to a set of 100 beetles for 24 hours for oviposition. The beetles are then removed and the pumpkin is placed in a cage as described under production of mealybugs. The beetles during the period of exposure feed on mealybugs and deposit their eggs singly or in groups of 4-12. The grubs are visible in such cages within a week of exposure to beetles. For facilitating the pupation of grubs, dried guava leaves are kept at the base of each of the cages. The first beetle from the cages start emerging on 30th day of exposure to *C. montrouzieri* adults. The beetles are collected daily and kept in separate cages for about 10 to 15 days to facilitate completion of mating and pre-oviposition period. The beetles are also fed on diet containing agar-agar (1g), sugar (20g), honey (40cc) and water (100cc).

Preparation of honey-agar medium:

The adult beetle diet is prepared by boiling sugar in 70 cc of water, adding 1g agar-agar powder, diluting 40 cc honey in 30 cc of water and adding to the sugar and agar mixture when it comes to boiling. The hot liquid diet is dropped on small white plastic cards in the form of droplets which solidifies on cooling. This diet can be used as a food supplement or it can be used while sending shipments of beetles. From each cage about 175 beetles are obtained. The emergence of beetles is completed in 10 days. The five day old pupae of the predator can be stored at 10°C for three weeks.

Field release:

Studies have indicated that control can be achieved within 3-4 months of release of *Cryptolaemus* at the rate of 5000 beetles/ha. The predators can be obtained from commercial insectaries established in Maharashtra, Karnataka and Tamil Nadu by booking well in advance on payment.

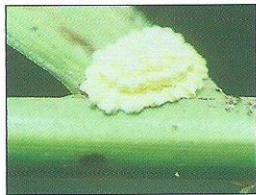
Precautions

1. **Control of foraging ants before release:** Since ants attack the predators and reduce their effectiveness, an insecticide like malathion 0.05% or chlorpyrifos 0.04% is applied around the trunk or in the ant holes throughout the garden, 15 days before release of the beetles, to check the action of ants on the trunk.
2. Insecticidal applications for other pests of grapevine have to be suspended two weeks prior to the release of natural enemies. However, dichlorvos, botanicals and all fungicides can be used.
3. The biocontrol agents have to be released either in the morning (0800 - 0900 hrs) or in the evening after 1600 hrs.
4. Advance planning is a must to go in for a biocontrol programme

Other mealybugs attacking grapevine: A total of sixteen species of mealybugs have been reported to damage grapevine throughout the world. In India, in addition to *M. hirsutus*, seven other species viz., *Dysmicoccus brevipes*, *Ferrisia virgata*, *Nipaecoccus viridis*, *Planococcus robustus*, *Planococcus citri*, *Planococcus minor* and *Xenococcus annandalei* have been recorded from different parts.



Colony of *P. minor*



N. viridis female



P. citri female



F. virgata female

Mealybug species	Natural enemies
<i>Dysmicoccus brevipes</i>	<i>Cryptolaemus montrouzieri</i> <i>Scymnus coccivora</i>
<i>Ferrisia virgata</i>	<i>C. montrouzieri</i> <i>S. coccivora</i> <i>Blepyrus insularis</i>
<i>Maconellicoccus hirsutus</i>	<i>C. montrouzieri</i> <i>S. coccivora</i> <i>Allotropa japonica</i> <i>Anagyrus dactylopii</i>
<i>Nipaecoccus viridis</i>	<i>C. montrouzieri</i> <i>S. coccivora</i>
<i>Planococcus robustus</i>	<i>C. montrouzieri</i> <i>S. coccivora</i> <i>Leptomastix dactylopii</i>
<i>Planococcus citri</i>	<i>C. montrouzieri</i> <i>S. coccivora</i> <i>L. dactylopii</i> <i>Coccidoxenoides peregrina</i>
<i>Planococcus minor</i>	<i>C. montrouzieri</i> <i>S. coccivora</i> <i>L. dactylopii</i>
<i>Xenococcus annandalei</i>	<i>C. montrouzieri</i> <i>S. coccivora</i>



S. coccivora adult



L. dactylopii adult



A. dactylopii adult

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