

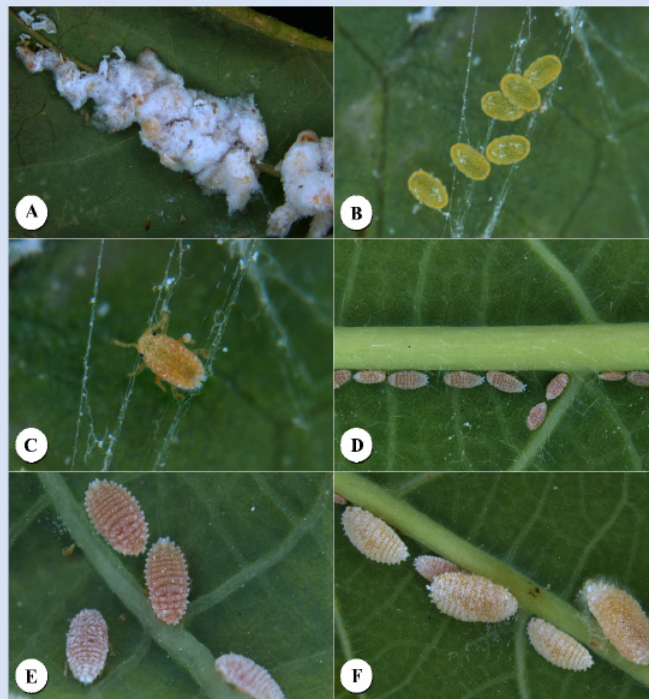
Cassava popularly called as tapioca in India is an important industrial crop. India is the fifth largest producer of tapioca tubers in the world. It is cultivated predominantly in the southern states, of which Tamil Nadu and Kerala are responsible for 51.9% and 31.7% of area and 57.8% and 34.9% of production respectively. It is also grown in Andhra Pradesh, Nagaland, Assam, Meghalaya, Karnataka, Madhya Pradesh and to some extent in Pondicherry, Tripura, Mizoram and the Andaman & Nicobar Islands. India exports around 3563 tonne of value added cassava by-products and flour to nearly 18 countries with export revenue generation of rupees 200 million for the year 2019-20.

Due to increased globalization and trade, India became the victim for entry of many invasive pests. One such recent entry is the cassava mealybug (CMB), *Phenacoccus manihoti* (Hemiptera: Pseudococcidae). CMB is one of the most destructive pests of cassava, distributed across Neotropical, African and Asian regions. Its presence in India was first reported by ICAR-NBAIR, Bengaluru during May 2020 from the cassava plant samples collected from Thrissur, Kerala. Subsequent surveillance undertaken by ICAR-NBAIR indicated its severe population outbreak in the predominant cassava growing belts of Namakkal and Salem districts of Tamil Nadu.



### Biology of CMB

Cassava mealybugs are ovoid, pinkish and dusted with white powdery wax. Body segments are apparent, bear very short lateral and caudal white wax filaments in the form of swellings that produce a toothed appearance to the body outline. CMB reproduces by thelytokous parthenogenesis (female progeny). A single female can lay up to 500 eggs in an ovisac at the terminal shoot tips, lower leaf petioles and under surface of the leaves. Eggs are golden yellow and oblong shaped. The 1<sup>st</sup> instar nymphs (crawlers) are highly mobile, responsible for migration and colonization. The 2<sup>nd</sup> and 3<sup>rd</sup> nymphal stages and the adult female are sedentary. Both nymphs and adults are responsible for sucking the sap from the plant parts. Under an optimal condition, the entire life cycle is completed within 20 days.



Life stages of CMB; Ovisacs (A), Eggs (B), 1<sup>st</sup> instar (C), 2<sup>nd</sup> instar (D), 3<sup>rd</sup> instar (E), Adult females (F)

### Extent of damage on cassava

The CMB feeds on the sap of the plants that leads to chlorosis, stunting of plants, drying / wilting of shoot tips, crinkling and multiple shooting (bunchy top). Due to honeydew secretion, the plants may be covered with the growth of sooty mould fungus that inhibits normal photosynthesis. Surveillance studies undertaken at Edappadi block in Salem District, Namagiripettai, Rasipuram and Senthamangalam blocks in Namakkal District during the crop season of 2020 revealed a very severe infestation of CMB on cassava plants (7.0 - 86.7% infested plants). The shoot tips with > 1000 mealybugs (scale 4) and shoot tip damage score of five (maximum) were recorded in many fields. The commonly grown cassava varieties such as Thailand white, Mulluvadi, H-165, Sree Vijaya and Sree Athulya were found severely damaged by CMB. Plants infested by CMB were not only stunted but also registered poor harvest indices due to reduction in tuber size and numbers.



Bunchy top symptom

## Alternate host plants

Cassava mealybug is an oligophagous pest which mainly colonizes *Manihot* species. However, there are reports of its occurrence on soybean, *Citrus* spp., sweet potato and Poinsettia in other countries. Evidence of its occurrence on *Alternanthera sessilis* (Amaranthaceae), *Synedrella nodiflora* (Asteraceae) and *Blumea lacera* (Asteraceae) was documented from Kerala.

## Natural enemies of CMB

An array of natural enemies, mostly predators, *Hyperaspis maindroni*, *Scymnus coccivora*, *Cheilomenes sexmaculata* (Coleoptera: Coccinellidae), green lacewings (Neuroptera: Chrysopidae), *Cardiastethus* sp. (Hemiptera: Anthocoridae) and *Spalgis epius* (Lepidoptera: Lycaenidae) were found predated on the CMB colonies collected from Tamil Nadu and Kerala. The fungus, *Neozygites* sp. infesting CMB is also reported.

## The classical biocontrol agent, *Anagyrus lopezi*: an unsung hero

Taking clue from the successful biological control of CMB by a monophagous solitary parasitoid, *Anagyrus lopezi* (Hymenoptera: Encyrtidae) in Africa and Thailand, ICAR-NBAIR is making serious efforts to import the *A. lopezi* into India. ICAR-NBAIR has already been granted import permit by Govt. of India for importation of this parasitoid from Thailand and IITA, Republic of Benin. The outcome of such classical biological control will not only suppress the CMB and restore cassava productivity but will equally offer other positive socio economical and ecological outcomes.



## Reasons for outbreak of CMB

- High temperature coupled with low humidity and drought like condition.
- High fecundity and short life cycle of CMB.
- Being an invasive, free of any effective native natural enemies.

## Management of CMB

- Collection and burning of mealybug infested plants.
- Avoid using infested cassava sets for planting and varieties susceptible such as Mulluvadi, Thailand types, H-165, Sree Vijaya and Sree Athulya. The cultivars found less infested with CMB were H-226 and the traditional annual type.
- Dip the sets in any of the contact insecticides with sticker for 15 minutes before planting.
- Release of ladybird beetles (*Scymnus coccivora*) @ 500-2000 beetles/ac depending on the severity of the infestation.
- Application of *Lecanicillium lecanii* during humid or rainy days @ 5g/lit ( $1 \times 10^8$  cfu/g) along with stickers.
- Application of neem seed kernel extract @ 5 ml/lit or any neem formulation (minimum 10000 ppm Azadirachtin) @ 2 ml/lit or fish oil rosin soap @ 25 g/lit with stickers either alone or in combination with one of the following insecticides (originally recommended for the management of papaya mealybug): Buprofezin 50 EC @ 0.75ml/lit or dimethoate 30 EC @ 2 ml/lit or thiamethoxam 25WG @ 0.6g/lit or imidacloprid 17.8 SL @ 0.6ml/lit or dichlorvos 76 EC @ 2 ml/lit or chlorpyrifos 20 EC @ 2 ml/lit or profenophos 50 EC @ 2 ml/lit.

## Invasive cassava mealybug (CMB), *Phenacoccus manihoti* a potential threat for cassava cultivation in India



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