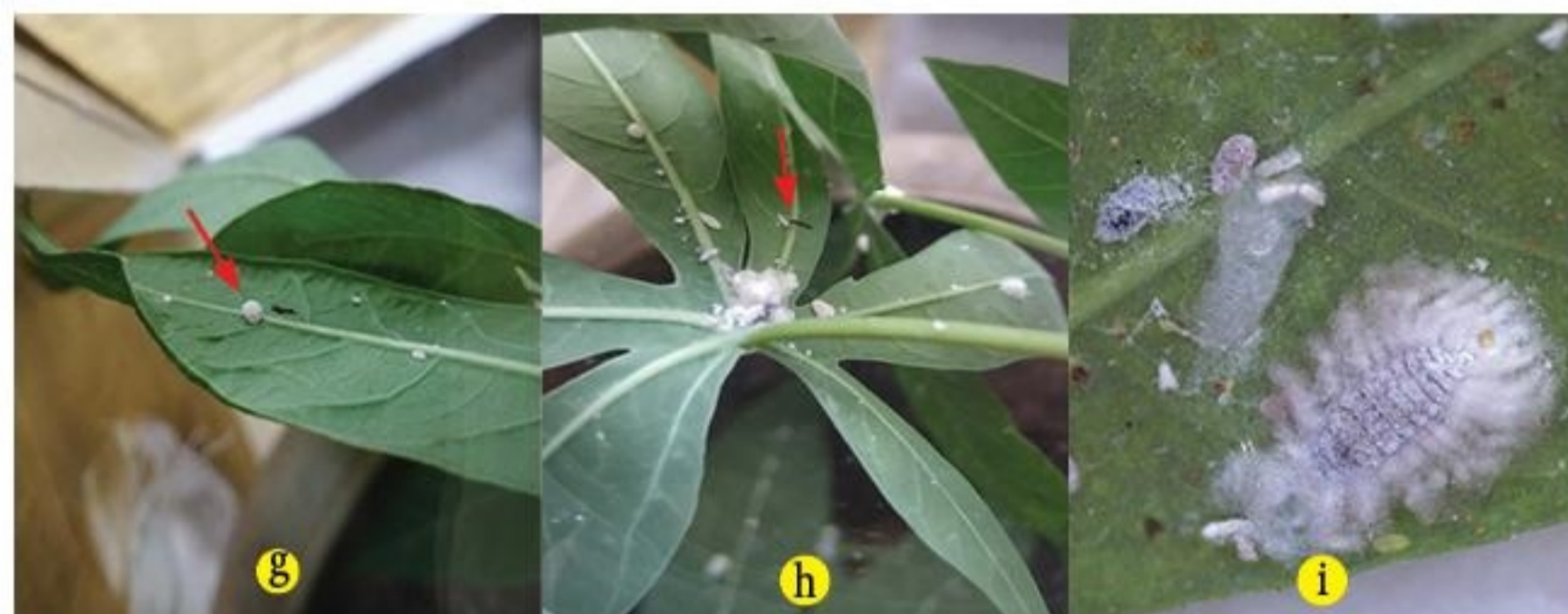


### Points to be remembered for successful rearing of *A. lopezi*

- Anagyrus lopezi* is highly host and stage specific, hence, ensure optimal number of third instar nymphs (g) and pre reproductive adults (h) of the cassava mealybug in the colonies for maximum parasitization (i) and production of female parasitoids.



- One should be aware of the similar looking hyperparasitoid, *Homalotylus turkmenicus* in the field or in rearing facility that parasitizes the grubs of ladybird beetle, *Hyperaspis maindroni*. In any case farmers should not confuse the CMB parasitoid, *A. lopezi* with this hyperparasitoid.



*Anagyrus lopezi* (Parasitoid)



*Homalotylus turkmenicus* (hyperparasitoid)

### Release procedure

- There are no reliable means of estimating the minimum number of parasitoid adults for field release. It depends on the level of CMB infestation, weather factors, the presence of other natural enemies and hyperparasitoids in the field. Inoculative release of *A. lopezi* @ 200-250 parasitoids per acre is ideal.
- The parasitoids should be field released either in the morning or evening hours. It is recommended to release at multiple points in a field for a good distribution.
- Avoid application of pesticides during or after parasitoid release. If pesticide application is inevitable, leave a small patch of the released field unsprayed or staggered spraying of adjacent fields.

### Requesting parasitoid culture

Email / call for all parasitoid requests and for any other clarifications to:

**The Director,**  
ICAR- NBAIR  
H.A. Farm Post, Bengaluru - 560 024.  
Karnataka, Tel: +91 80 2351 1998  
E-mail: director.nbair@icar.gov.in

**The Professor & Head**  
\*Tapioca and Castor Research Station, TNAU  
Yethapur, Salem, Tamil Nadu - 636 119  
Tel: +91 4282 299731  
E-mail: arsyethapur@tnau.ac.in

## Mass production and release technique of *Anagyrus lopezi* wasp for classical biological control of invasive cassava mealybug in cassava (tapioca) plantations

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### Cassava – An industrial and food crop

Cassava (Tapioca) is a major food crop for more than 500 million people in the tropical countries of Africa, Asia and Latin America. India has the highest productivity of cassava (35.0 t/ha) in the world as against the world average of 11.08 t/ha. As per 2019-20 statistics, cassava is grown over an area of 1.73 lakh ha with total production of 60.6 lakh tonnes in India. It is cultivated in many states but predominantly in the southern states of which Tamil Nadu and Kerala are responsible for 46.9% and 35.9% of area and 50.6% and 42.8% of production respectively.

### Outbreak of invasive cassava mealybug

Increased globalization and trade have made India a targeted entry for many new alien insect pests. One such unintentional recent introduction is the cassava mealybug (CMB), *Phenacoccus manihoti*, reported by ICAR-NBAIR on cassava during 2020 from Thrissur, Kerala. Within a short period of time, it has spread to all the cassava growing areas of Tamil Nadu and Kerala with drastic reduction in harvest index (60.7 - 93.3%). Though several native natural enemy species were recorded on CMB in India, none found promising.



Havoc caused by cassava mealybug on cassava



Mealybug complex: a. Jack beardsley mealybug; b. Papaya mealybug; c. Cassava mealybug

*Phenacoccus madeirensis*, *Phenacoccus solenopsis*, *Pseudococcus jackbeardsleyi* and *Pseudococcus longispinus*. Mixed populations of cassava mealybug along with papaya mealybug is quite common in many cassava plantations.

### Importation of *Anagyrus lopezi*, a classical biocontrol agent



Taking cue from the successful biological control of CMB in Africa and other Asian countries, ICAR-NBAIR, Bengaluru has acted swiftly in importation of the parasitoid wasp, *Anagyrus lopezi* (Encyrtidae: Hymenoptera) from the sub centre of International Institute of Tropical Agriculture (IITA), Benin, West Africa (Govt. of India import permit No. 17/2020-21 dated 29 October 2020). As per the MTA signed between IITA and NBAIR, a shipment of the parasitoid wasp arrived India on 13 August 2021.

### Mass production of *A. lopezi*

ICAR-NBAIR has standardised the mass production protocol of this parasitoid on CMB infested cassava plants. Under laboratory conditions, the parasitoid completes its life cycle between 18 and 20 days. Protray method of raising cassava (d) for CMB infestation and parasitoid multiplication is under investigation.



Raising of cassava plants and mealybug infestation

The male and female wasps immediately after emerging from the cocoons under netted enclosure should be collected with the help of aspirator and released (1:1 ratio) in test tubes or any rearing box / jar for mating. Honey strips or honey streaked on glass surface act as a food source to the mating pair. The unmated female lays unfertilized eggs that develops into male parasitoids.

One to two day old mated pairs (10 numbers) could be released on the CMB infested plants. Predominant presence of third instar nymph and pre-reproductive adult mealybugs should be ensured. After 3-5 days of parasitoids exposure on the mealybug, the cassava plants could be removed and placed in a cage or netted structure till adult parasitoids emergence.

Fresh set of mealybug infested cassava plants can be placed in the oviposition cage (e)/netted structure(f) for oviposition by the parasitoids. Likewise, the procedure can be repeated till the parasitoid dies. If required, fresh sets of mated parasitoids can be released. After about 18-20 days of oviposition, the parasitoid adult emerges. The adults can be collected with aspirator and used for field release. Depending on the demand for the parasitoid, the number of cages / netted structure could be increased for further up scaling of the production.



Mass production of *A. lopezi* parasitoid

*In situ* mass production of *A. lopezi* at farmers level could be done under field net cages (7x7x7 ft) by release of 50-100 parasitoids. After 10 days of parasitoid release on the CMB colonised setts, the same can be cut and spread across the field for parasitoid emergence, distribution and subsequent parasitization on the CMB colonies. The parasitized twigs could be supplied to the nearby farmers in order to initiate the production. This kind of community approach among the farming fraternity would certainly results in suppression of CMB in a short span of time.