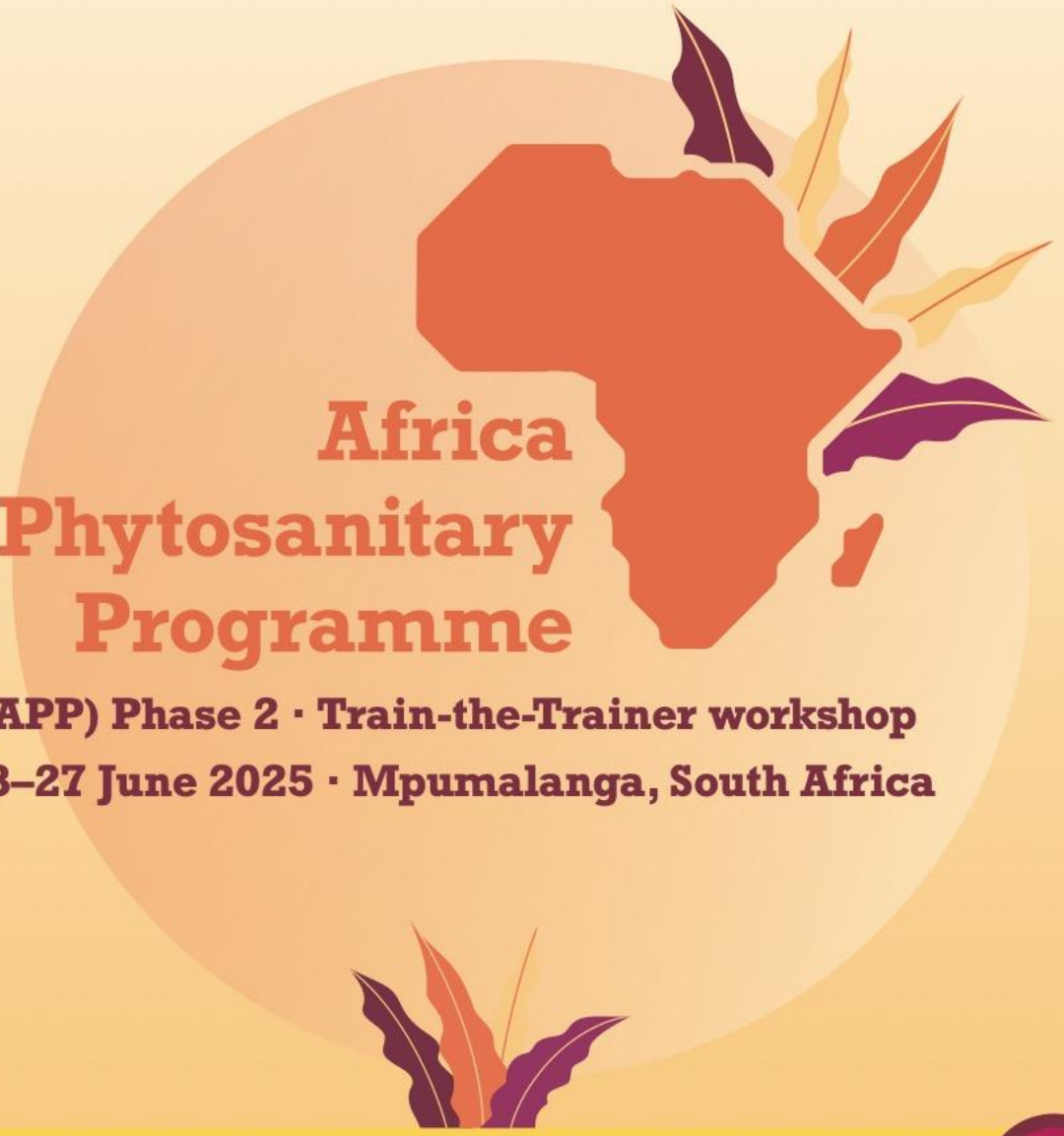

Field survey guidance for *Paracoccus marginatus*

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Introduction

- The papaya mealybug, *Paracoccus marginatus*, is a **polyphagous** sucking insect pest
- Attacks over 250 plant species belonging to 189 genera and about 58 plant families
- Economical important host crops; papaya, cassava, avocado, citrus, cotton, tomato, eggplant, sweet potato, mango
- Origin from Central America / Mexico
- First reported on African continent in 2010 in West Africa

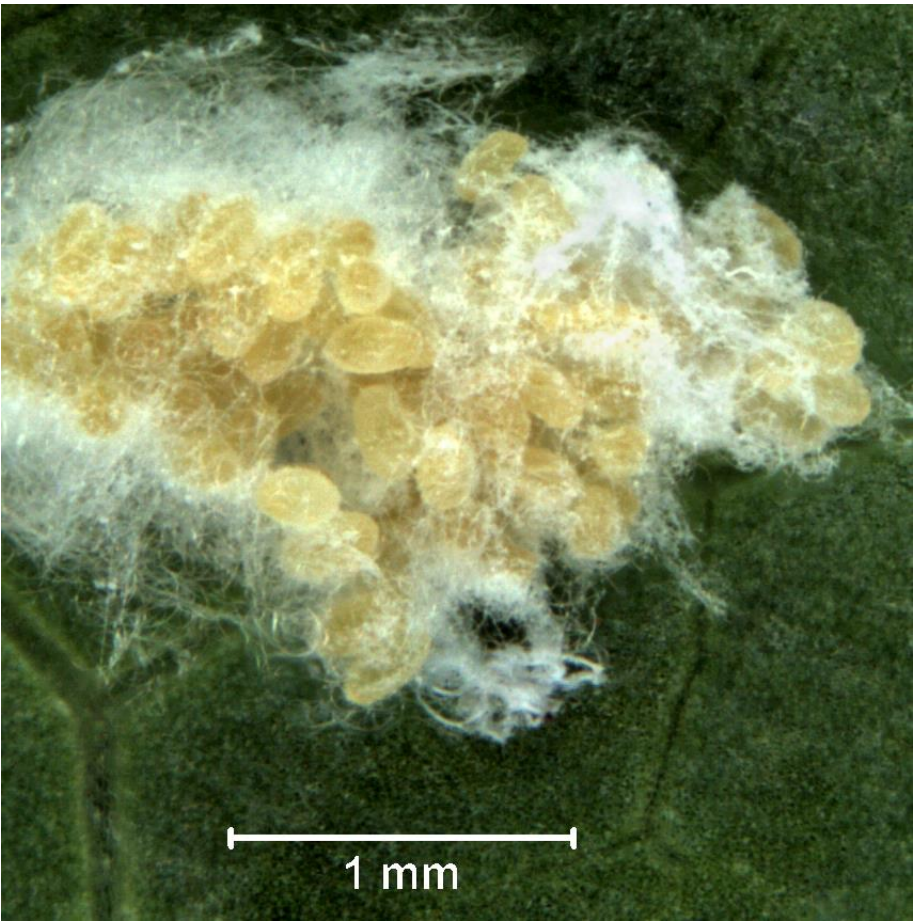
Biology and identification

- *Paracoccus marginatus* **female body** is yellow covered with a white waxy coating
- Adult female have an elongated oval body approximately 2.2 long and 1.4 mm wide
- Have short waxy filaments, less than 1/4 the length of the body around the margin.
- Adult females lay eggs (100- 600) that are greenish yellow in an ovisac (three to four times the body length)

Male *Paracoccus marginatus*

- Pink colored during the pre-pupal, pupal and adult stages
- Well-developed wings
- Adult males have ten-segmented antennae
- Adult males are approximately 1.0 mm long, with an elongate oval body that is widest at the thorax (0.3 mm).
- A heavily sclerotized thorax and head

Eggs of *Paracoccus marginatus*

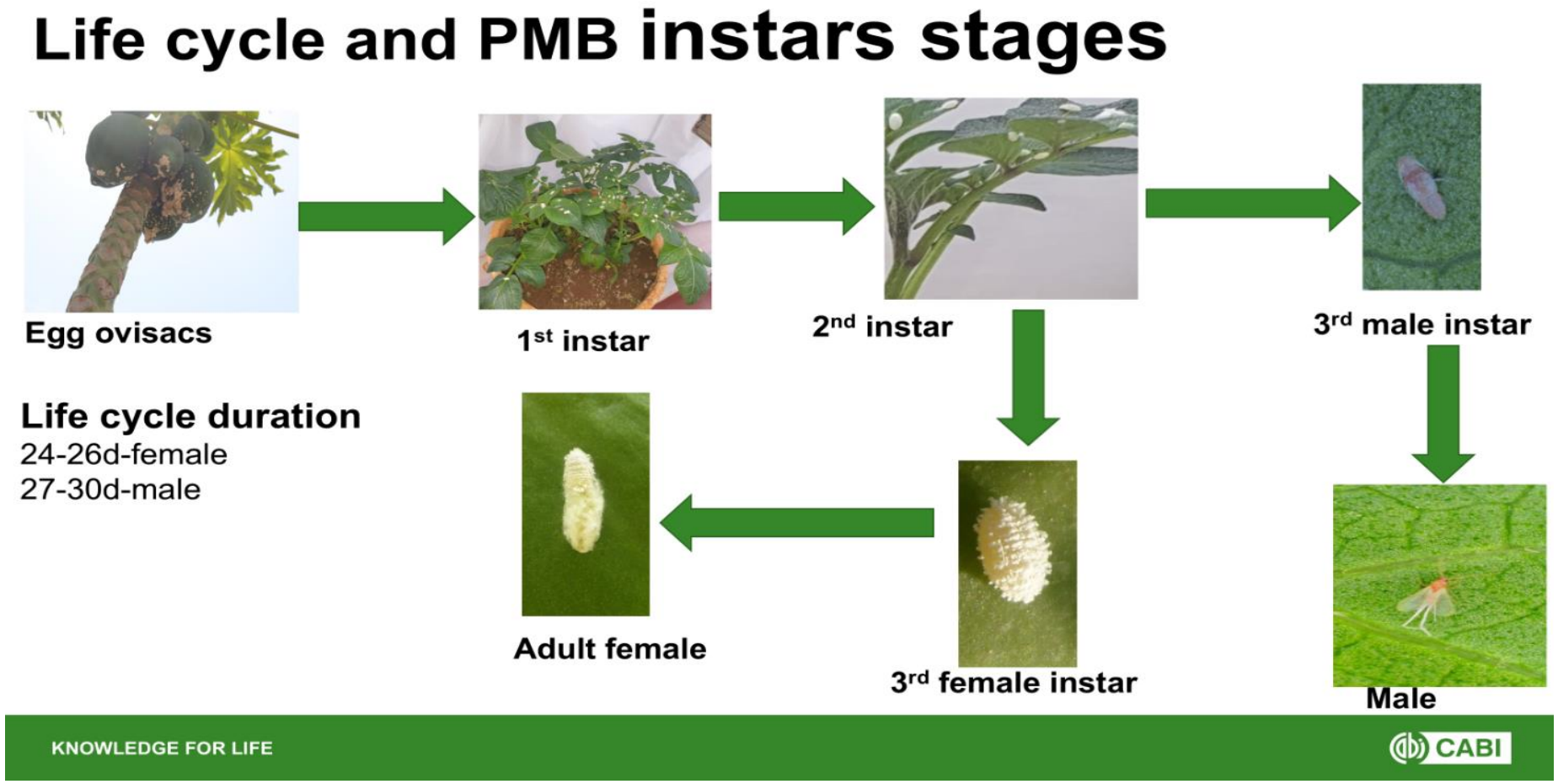


- Greenish yellow
- They are laid in an ovisac containing 100 - 600 eggs
- The ovisac is developed ventrally on the adult females.

Nymphal stages

- Eggs hatch in about 10 days into first instars referred to as ‘crawlers’
- Crawlers are active and moves freely to settle on the soft portion of the stems and leaves and start feeding by sucking the sap
- The female mealybug has three nymphal stages before molting into adult stage, ‘females develop as **mealybugs’**
- The male has two immature larval stages, followed by prepupal and pupal stages before it molts into **winged adult**
- There is **no distinguishable** difference between male and female crawlers, and male and female second instars

Papaya Mealybug Life Cycle CABI, 2022



SURVEY PROTOCOL

Materials Needed

- Ladder for taller papaya trees
- GPS device or smartphone with GPS capabilities
- Hand lens (10x magnification)
- Collection vials, containers or paper envelopes
- Data sheets or digital forms for recording observations
- Camera or smartphone for photographic documentation
- Labels and permanent markers
- Appropriate personal protective equipment (gloves, hats, boots)

Time of year to survey

- A survey should be conducted **regularly**, mostly during the **growing** season of the host plants
- This should be done preferably during warm and dry weather when papaya mealybugs are most active
- **Heavy rainy season** causes increased mortality of papaya mealybug, especially the mobile first-instar crawlers

Survey site selection

- Select papaya orchards across **representative agroecological zones** using a constant distance interval
- Ensure sampling covers fields of varying ages, from newly **established to mature orchards**, and **diverse management practices,** including organic, conventional, and integrated pest management systems.
- Prioritize **locations near major transport hubs** or **border regions** that may serve as entry points for invasive pests.
- Consider **proximity to natural habitats**, **urban settings**, or other **agricultural crops** that could influence pest distribution
- Consult with **local agricultural authorities** and **farmer associations** to identify critical sites and facilitate coordination
- Request the farmer consent for a field visit and explain the survey process

Visual survey

- Inspect the papaya plants for stunting, deformation of apical growth

- Papaya mealybug causes damage by sucking the plant sap and injecting toxic substance into the leaves inducing plant tissue deformation

Visual survey

- Inspect the leaves, stems, flowers, and fruits and look for the following signs of infestation of papaya mealybug

- (1) Clusters of **cotton-like masses**

Visual survey

- Inspect the leaves, stems, flowers, and fruits and look for the following signs of infestation of papaya mealybug

(2) **Attendant ants** climbing to the plant canopy which are attracted to honeydew secreted by the *Paracoccus marginatus*

Visual survey

- Inspect the leaves, stems, flowers, and fruits and look for the following signs of infestation of papaya mealybug

(3) **Honeydew (droplets of sap) and sooty mold**

Sample collection and screening

1. Papaya plant Inspection

- Randomly select at least 20 plants per hectare or 10 plants per field.
- On each papaya plant randomly select 10 leaves
- Examine carefully the undersides of leaves, stems, fruits, and apical shoots.
- Check for the papaya mealybug presence on alternative host plants by inspecting at least 10 randomly selected plants in the surroundings of papaya fields

2. Identification and Recording

- Confirm the presence of papaya mealybug using a hand lens.
- Inspect the papaya plants for the presence of other mealybug species that may co-occur with the papaya mealybug
- Record the number of infested plants out of the total sampled to calculate incidence (%).
- Estimate the severity by counting or estimating the number of mealybugs per plant or per plant part.

Mealybugs co-occurring with PMB on papaya in tropical Africa

- *Ferrisia virgata* Cockerell, striped mealybug, frequently co-occurring with PMB, young instars can easily be confused with papaya mealybug, uniparental, producing ovisacs

- *Pseudococcus longispinus* (Targioni Tozzetti), long-tailed mealybug, occasionally on papaya in West and Central Africa, biparental, no ovisac (oviviparous)

Mealybugs co-occurring with PMB on papaya in tropical Africa

- *Pseudococcus jackbeardsleyi* Gimpel & Miller, Jack Beardsley mealybug, occasionally observed in West Africa, uniparental, no ovisac

- *Aleurodicus dispersus* Russell, Spiraling whitefly not a mealybug but a whitefly (Aleyrodidae), frequently observed on papaya leaves during the dry season and egg masses sometimes confused with young papaya mealybug instars

Refuge host plants at low PMB densities

- Cassava (*Manithot esculenta*): often mixed up with cassava mealybug on the tips and PMB at lower strata

- Peregrina or spicy jatropha (*Jatropha integerrima)* Euphorbiaceae. Ornamental multi-trunked tropical evergreen tree or large shrub, a native of Cuba

Specimen collection

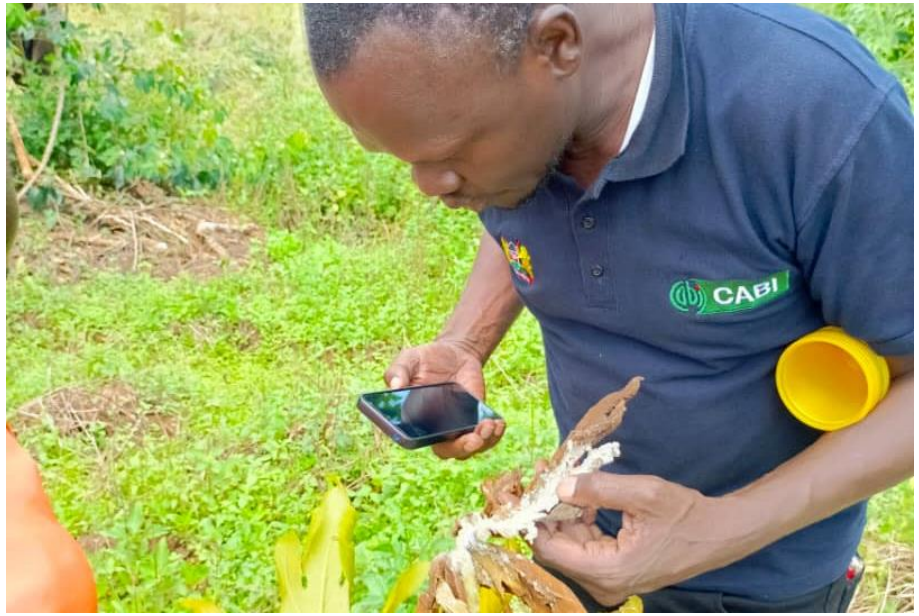
- Collect samples of mealybugs and their associated natural enemies for further identification and preservation. Double bag the samples in a Ziplock bag
- Record location, date, plant part, and collector's name
- Place specimens in labeled containers and transport them to the laboratory in cool boxes for pest extraction and identification.
- Papaya mealybugs can also be preserved in 80% ethanol for later identification. (Mealybugs turning to black within 24H or less = PMB (method by Walker et al., 2003*))

*Walker A, Hoy M, Meyerdirk D (2003) Papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink (Insecta: Hemiptera: Pseudococcidae). IFAS Extension Manual of University of Florida EENY-302, p 7

Data Recording

- Record the following data at each survey:

1. Date and time of survey
2. GPS coordinates of the surveyed site
3. Number and proportion of infested plants
4. Severity score or number of mealybugs per sampled plant
5. Observations on associated natural enemies (predators, parasitoids)
6. Photographic records of typical infestations and natural enemies



Basic Data Analysis

- Calculate infestation incidence (% plants infested) and average severity per site
- Map infestation hotspots using GPS data
- Track temporal changes in pest populations to assess effectiveness of control measures.

Africa Phytosanitary Programme

Train-the-Trainer workshop

Thank you

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