Integrated Pest Management to Sustain Coconut Development

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Good Agricultural Practices and Integrated Pest Management to Sustain Coconut Development

Coconut : “The tree of Life”

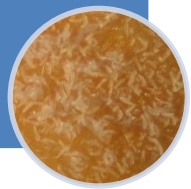
- A crop that plays a vital role in Asia and Pacific regions
  - Economically
  - Socially
  - Culturally
- Global coconut production (2018) : 61.86Mn Mt
- Production is limited by biotic and abiotic factors

Pests of coconut

>750 pest species are reported all over the world

Insects

Mites



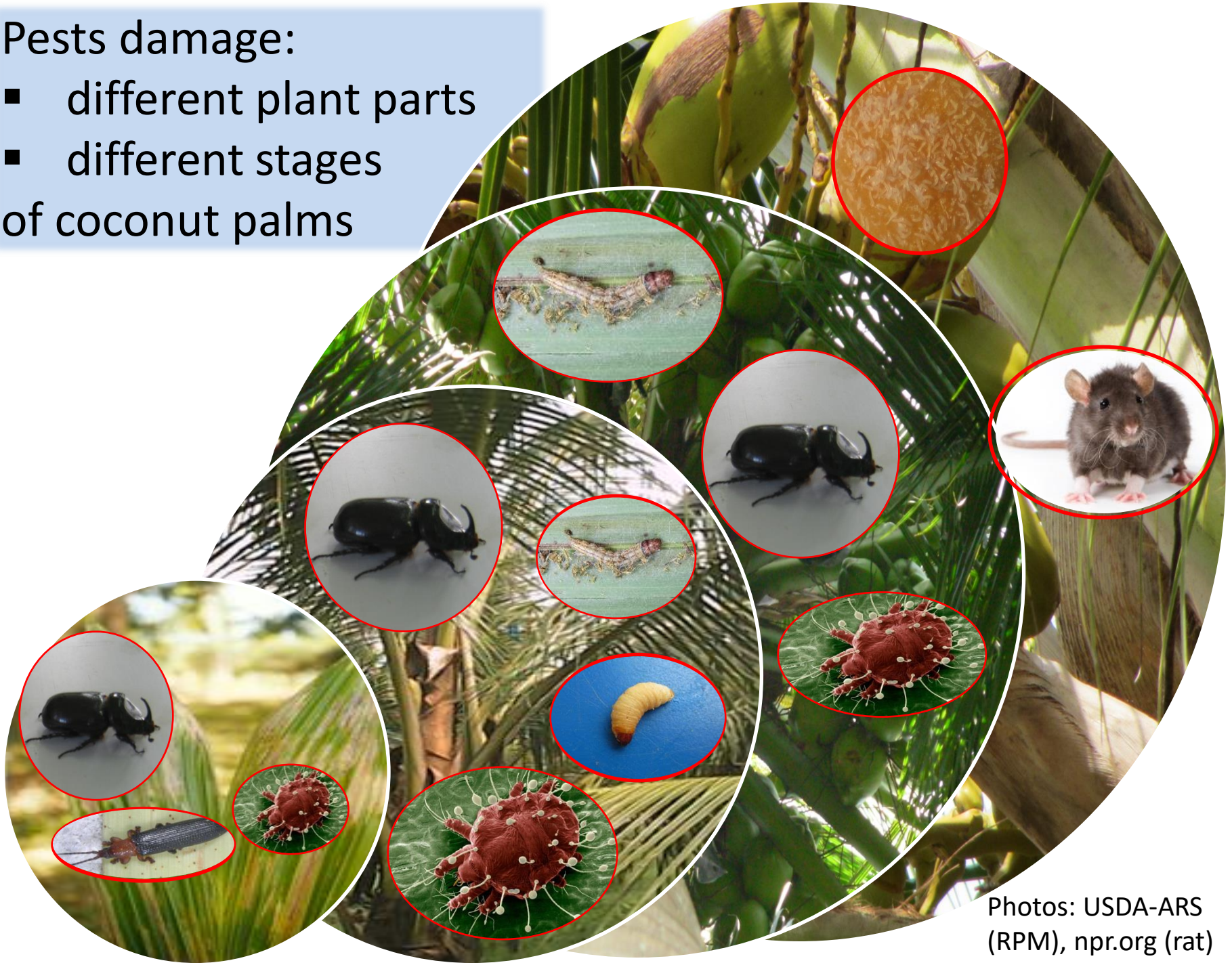
Mammals

(Photo : npr.org)

Pests damage:

- different plant parts
- different stages

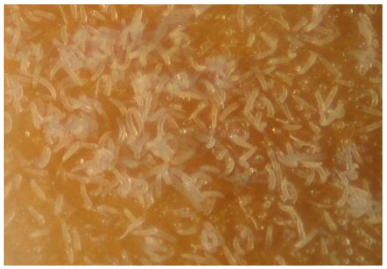
of coconut palms



Photos: USDA-ARS (RPM), npr.org (rat)

Major pests of coconut

Rhinoceros beetle
[*Oryctes rhinoceros*]



Eriophyid mite
[*Aceria guerreronis*]

Coconut black headed caterpillar
[*Opisina arenosella*]

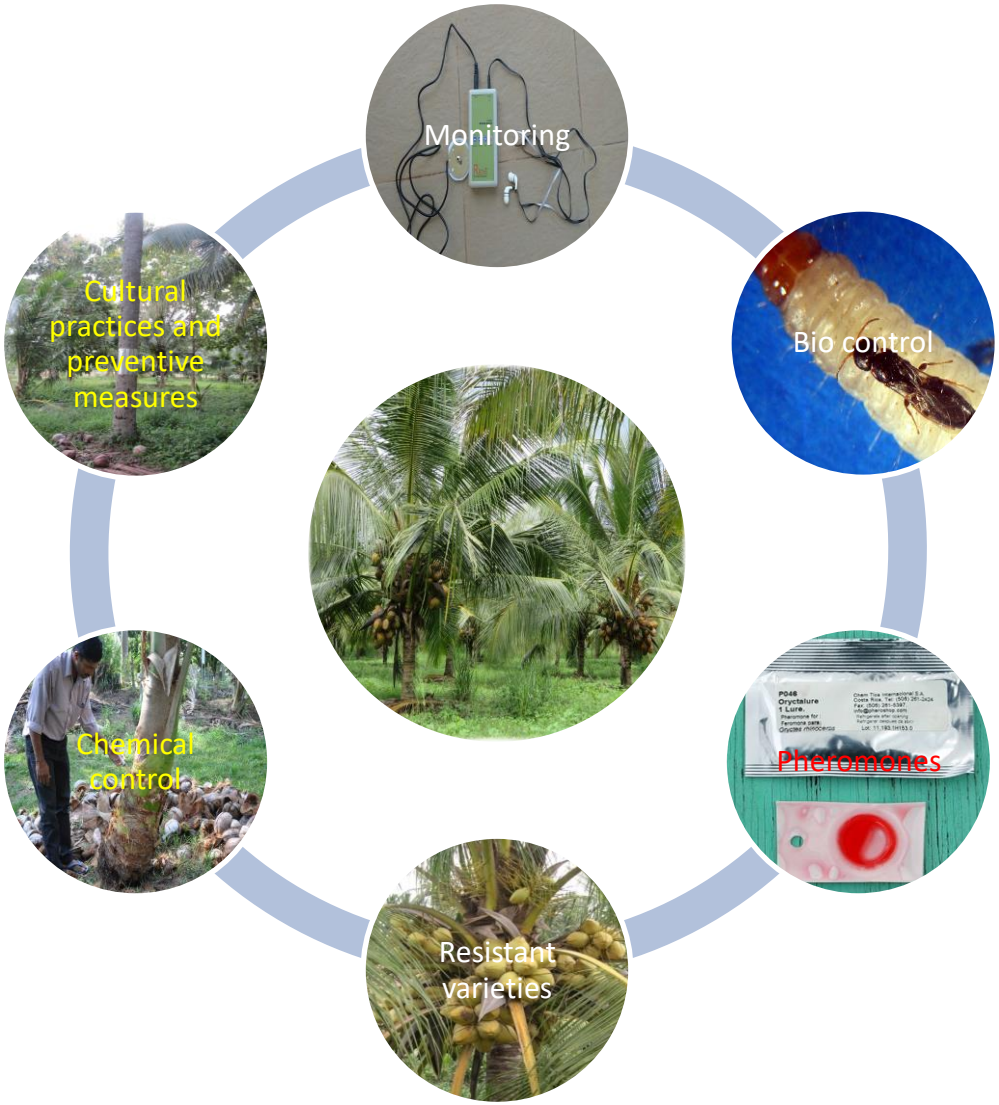
Red palm mite
[*Raoiella indica*]

Red palm weevil
[*Rhynchophorus ferrugineus*]

Coconut Hispine beetle
[*Brontispa longissima*]

Integrated pest management (IPM) in coconut

A sustainable approach of managing pests by combining **biological**, **cultural**, **physical** and **chemical** tools in a way that minimizes economic, health and environmental risks.



IPM in coconut

- Why:
  - A perennial crop : susceptible plant parts for pest damages are available year around.
  - A tall plant
    - Insecticide application is not always feasible/economical
    - Most of the insecticides are ineffective
    - Insecticide application comes always at a cost to the farmer
    - Pest damages go unnoticed

IPM in coconut

- Why:
  - Pests are concealed or only some instars are available on the palm. Therefore the control using one pest management tool is not practical.
    - E.g. Rhinoceros beetle, Red palm weevil, Coconut eriophyid mite
  - Even low toxic, environmental friendly pest management methods are not always applicable/effective in coconut pest management.
    - E.g. Rhinoceros beetle – Guam strain is not susceptible to any available *Or*NV strains

Avoidance and prevention of pests in coconut

Prompt disposal of breeding grounds

- Coconut logs, coconut husk, fibre dust, saw dust, cow dung, decaying vegetable matter

Spreading out breeding media to a thin layer and routinely examining the mulch around palm avoid breeding of Rhinoceros beetle and Rodents.

Avoidance and prevention of pests in coconut

- Selection of suitable lands for coconut planting
  - E.g. Poorly-drained soil increases pests as well as root and collar diseases (Skipper butterfly, Collar rot)
- Correct planting
  - E.g. Shallow planting can increase Red palm weevil incidence and deep planting can increase the Collar rot disease

Avoidance and prevention of pests in coconut

- Soil moisture conservation
  - Prevents moisture stress
  - Avoids pest population build up (E.g. Coconut eriophyid mite)
  - Reduces disease incidence such as stem bleeding
- Correct application of fertilizers
  - Increases the plant vigour and reduces the succulence of palms for pest attacks (by excess application of nutrients).

Mechanical methods

Extract Rhinoceros beetles using a metal hook

-winkling-

Mechanical methods

Cover the crown region to avoid the entry of Rhinoceros beetle

Mechanical methods

Tree-banding and baiting for Rodent management

Mechanical methods

Electronic detector for detection of Red palm weevil

Biological control

- The most environmental friendly and ecologically sound method
- Slow action but long lasting effects

- ✓ *Metarhizium anisopliae* [Green muscardine – GMF] fungus and *Oryctes rhinoceros* nudivirus (*Or*NV) for Rhinoceros beetle
- ✓ *Bracon hebetor, Brachmeria nephantidis* and *Trichospilus pupivora* for Black headed caterpillar
- ✓ *Tetrastychus brontispae* for Hispine beetle
- ✓ *Neoseiulus baraki* and *Hirsutella thomosonii* for Eriophyid mite

GMF fungus for Rhinoceros beetle

Use of *Or*NV

Parasitoids for coconut black headed caterpillar (CBH)

Bracon brevicornis parasitising the larva of CBH

(https://nbair.res.in/Databases/Featured_insects/Bracon-brevicornis.php)

Goniozus nephantidis larva on CBH larva

Predatory mites and entomopathogenic fungi for coconut eriophyid mite

(Prakya SR, 2011. Trends in Acarology)

Biological control of Coconut Hispine beetle, *Brontispa longissima*

- ✓ *Tetrastichus brontispae*
- ✓ *Asecodes hispinarum*
- ✓ Application of *Metarrhizium anisopliae*

Slide credit: Late
Dr. Amporn Winotai

Biological management of diseases

- Mainly by antagonistic microbes
  - Talc based formulation of *Pseudomonas fluorescens* and *Bacillus subtilis* consortium for leaf rot diseases
  - *Trichoderma* coir pith cakes for bud rot
  - Talc based formulation of *Trichoderma harzianum* (CPCRI TO 28) for stem bleeding

Host plant resistance for pests and disease management

- One of the most effective and perhaps the safest method especially in a perennial crop which stays in the field for more than 50 years.
- Greatly reduces the cost for post-establishment pest management.
- But development of resistant/tolerant varieties is difficult and time consuming.

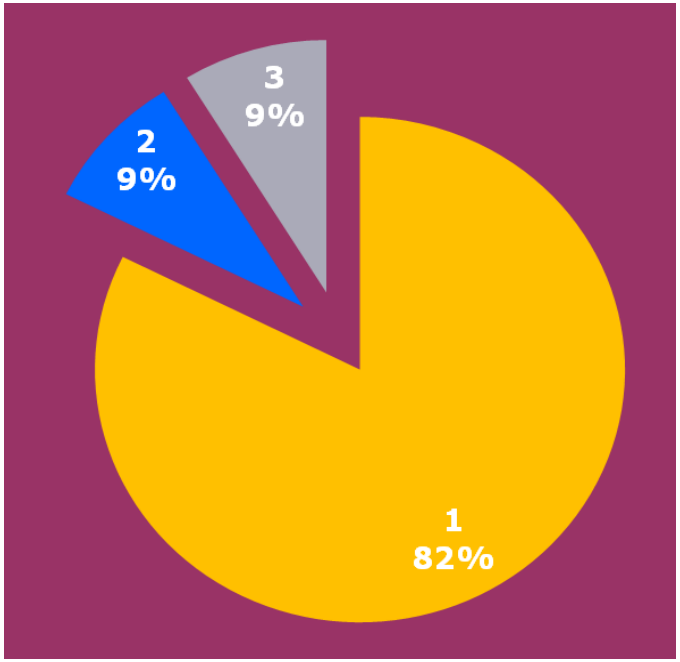
Tolerant varieties for Eriophyid mites in Sri Lanka

SL Yellow Dwarf

Gonthambili

Tolerant varieties for Eriophyid mites in India

Selection from Kulasekharam Green Tall



1= <25% surface damage
2= 26-50% surface damage
3= >51% surface damage

Mohan *et al.*, 2014

Host plant resistance for disease management

- India has released 3 resistant/tolerant varieties for Root Wilt Disease (a phytoplasma disease).
  - Kalparaksha (selection from Malayan Green Dwarf)
  - Kalpasree (selection from Chowghat Green Dwarf)
  - Hybrid Kalpasankara (Chowghat Green Dwarf X West Coast Tall)

- In Sri Lanka, Sri Lankan Green Dwarf (SLGD) has shown to be free of Weligama coconut leaf wilt disease in the endemic area.

Behavioural manipulation methods

Ethyl-4-methyl octanoate for Rhinoceros beetle

- Recommended for large plantations or villages
- 1 trap/1ha

Behavioural manipulation methods

4-methyl 5-nonanol for Red palm weevil

- 5 traps per ha
- Suitable for lands >2ha
- It is essential to continue other control methods and maintenance of the trap

Different types of traps

Behavioural manipulation methods

- Install traps in adult plantations or in non-coconut areas or along the periphery of the plantation.
- Government assisted farmer participatory approach is needed.

Botanicals

- Filling up of leaf axils with neem cake and botanical tablets for Rhinoceros beetle management
- Spraying 2% neem oil + garlic mixture, Azadirachtin and root feeding with neem formulations for Eriophyid mites
- Spraying of Azadirachtin for Coreid bugs

Use of chemicals for IPM in pest management of coconut

- The most effective method.
- But it has unfavourable effects on the environment and the coconut products (residual toxicity).
- Insecticides should be judiciously used based on the need.

Important component particularly in lethal pest management such as Red palm weevil and as a prophylactic measure for both pests and diseases.

Use of chemicals for IPM in pest management of coconut

- Burnt engine oil or coal tar, naphthelene balls, Gamma-BHC, Lambda Cyhalothrin and Cypermethrin for Rhinoceros beetle control
- Monocrotophos Pirimiphos ethyl, BHC mixed with sand, Fipronil, Carbaryl, Imidacloprid for Red palm weevil control
- Lambda Cyhalothrin for Coreid bug control

Use safe methods for insecticide applications

Trunk injection and root feeding of insecticides

Quarantine

- Vigilance at seaports and airports against hitchhiking pests
- Follow FAO/IBPGR Guidelines for Safe Movement of Coconut Germplasm

  - Rhinoceros beetle – Guam type
  - Coconut Hispine beetle
  - Coconut False Scale (*Aspidiotus rigidus*)
  - Red palm mite (*Raoiella indica*)

Crop habitat manipulation and diversification

Volatile confusion and disorientation

Pest and disease incidence can be lowered by careful integration of other non host crops and the crops that harbour natural enemies of the pests in the cropping system.


Thank you