ForHeal Forestry Higher Education Advancement in Laos

Co-funded by the Erasmus+ Programme of the European Union

Forest protection in Asia and Pacific

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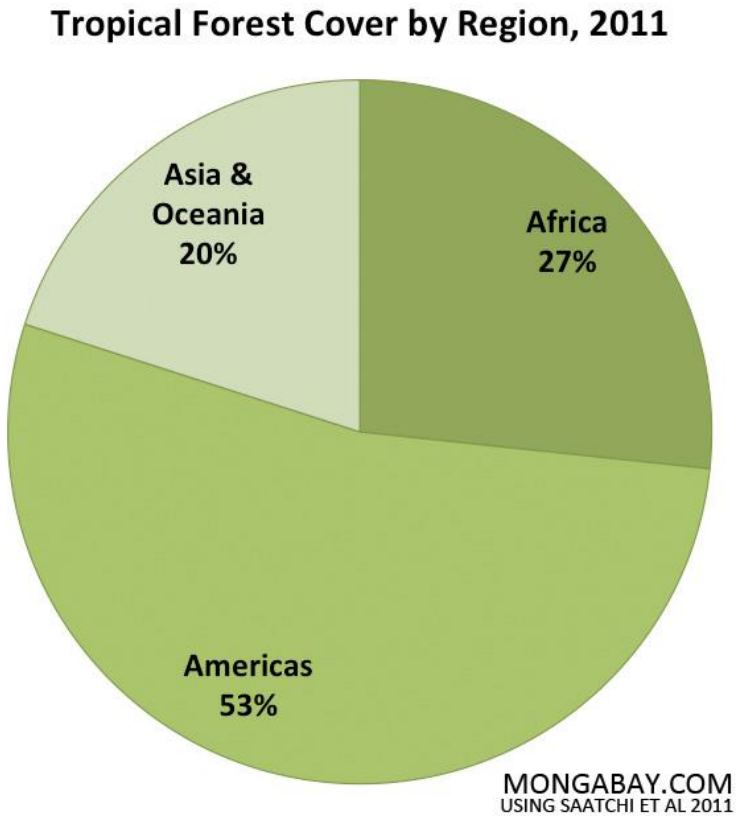
Introduction

- Forest lands across Asia cover an area of over 500 million hectares
- In particular, the tropical forests of the region are vital carbon stores, reservoirs of biodiversity, homes to millions of ethnically rich people and sources of medicinal plants, food and both timber and non-timber forest products



ForHeal

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- considerably more pests (77 %) were reported in planted forests
- the world's highest plantation rates are found in Asia (China is one of the top ten countries for productive forest plantations

FIGURE 3
Number of forest pest species reported, Asia and the Pacific

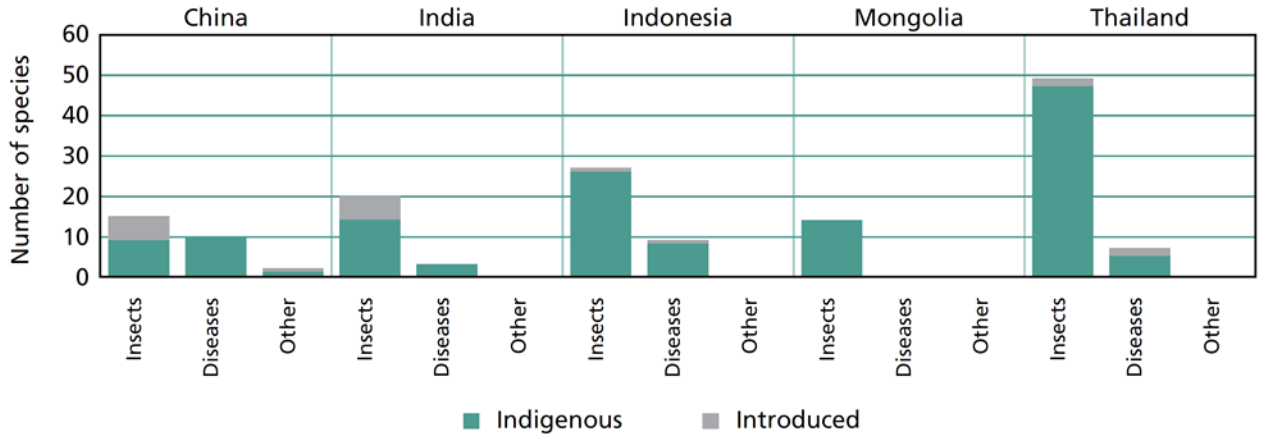
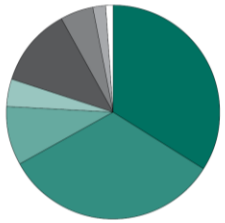


FIGURE 4
Most prevalent species, Asia and the Pacific



Insects
- Lepidoptera 34%
- Coleoptera 33%
- Hemiptera 9%
- Other insects 4%

Diseases
- Ascomycota 12%
- Basidiomycota 5%
- Other diseases 2%

Other
- Other pests 1%

Forest Protection

- **The Asia-Pacific Forest Invasive Species Network (APFISN)**
- Several mechanisms are in place to facilitate information exchange including a network Web site, newsletters and a regional forest invasive species list server.
- The **Chinese Academy of Sciences** has also begun work on developing a forest invasive species database which will provide a system for collating, storing and readily accessing information gathered by the network.
- **The Asia and Pacific Plant Protection Commission (APPPC)** administers an intergovernmental treaty, the Plant Protection Agreement for the Asia and Pacific Region, and is an RPPO under the IPPC (24 countries).

Main forest pests and diseases

Teak defoliator – *Hyblaea puera*

- main pest of teak plantations
- adult moths are comparatively small, with a wingspan of 3–4 cm, and have a characteristic resting posture that conceals the black and orange-yellow hindwings under the greyish-brown forewings.
- 1 mm long eggs are laid on tender new leaves, placed singly near the veins, and usually on the, about 500 eggs are laid per female with a recorded maximum of 1000 undersurface

Teak defoliator – *Hyblaea puera*

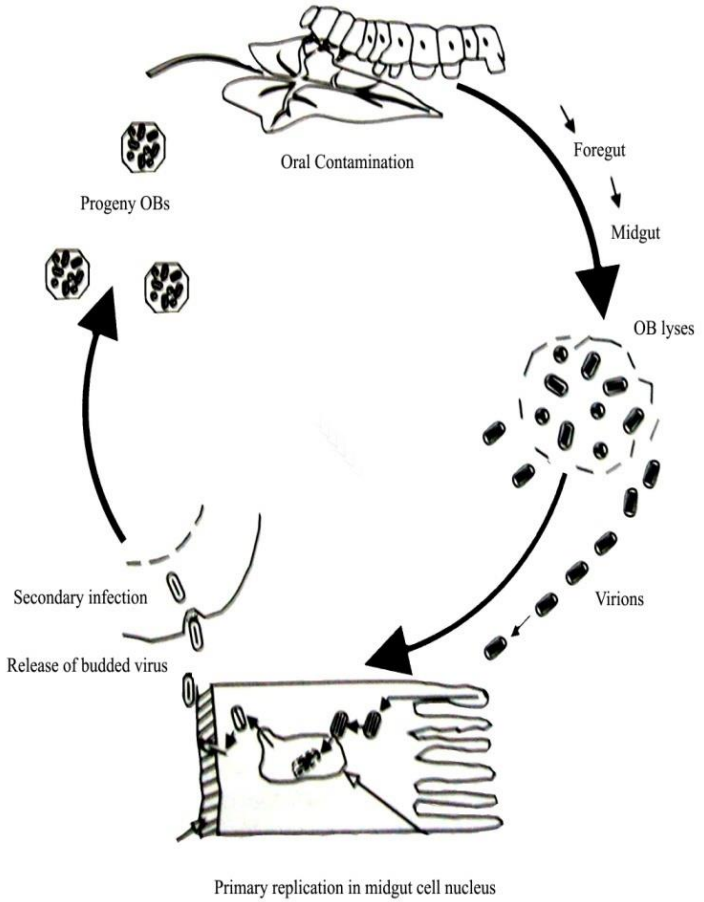
- There are five larval instars. The first and second instars mainly feed on the leaf surface. Starting with the third instar, the larva cuts out a leaf flap, usually at the edge of the leaf, folds it over, fastens it with silk, and feeds from within.
- The mature larvae descend to the ground on silken threads and pupate under a thin layer of leaf litter or soil

Teak defoliator – *Hyblaea puera*

- **Symptoms:** partially eaten leaves, total defoliation and the ground is littered with fallen leaf skeletons
- **Biological control:** There is known a great number of parasitoids of teak defoliator. The predatory wasps, spiders and birds help to control their numbers too. And there are few pathogens causing mortality of them.

HpNPV vi

- An absolutely specific virus with refractile polyhedral inclusion bodies, named as *Hyblaea puera* nucleopolyhedrovirus (HpNPV) is found to be very effective in the biological control of this pest.
- The NPVs come under the family of baculoviridae and its virions are enveloped rod shaped nucleocapsids containing circular, supercoiled, double stranded DNA.



Siberian silk moth – *Dendrolimus sibiricus*

- Destructive pest of conifers in naturally regenerated and planted forests
- Host trees: *Larix, Pinus Abies, Picea* and *Tsuga*
- Adult Siberian moths are yellowish-brown or light grey to dark brown or almost black. The forewings are marked by two characteristic dark stripes and a white spot in the centre.
- Females are approximately 40 mm long with a wing span of 60 to 80 mm while males are approximately 30 mm long with a 40 to 60 mm wing span
- Larvae are mainly black or dark brown with numerous spots and long hairs.

Siberian silk moth – *Dendrolimus sibiricus*

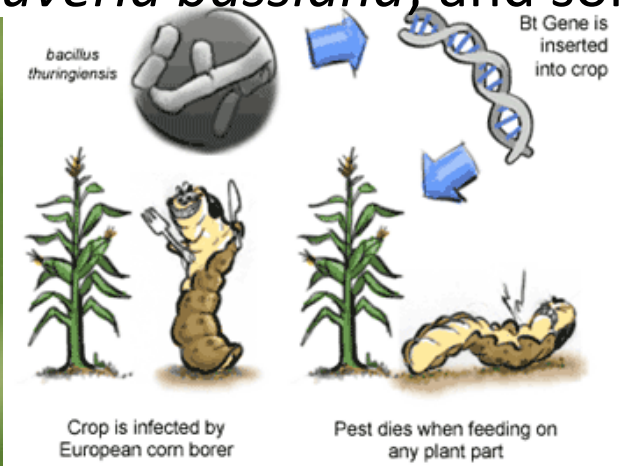
- Spring flight usually occurs in mid-July
- Females lay eggs on the needles primarily in the lower part of the crown
- Each female lays an average of 200 to 300 eggs, with a maximum of 800
- There are 6 to 8 larval instars.
- They overwinter in soil in larvae stadium twice
- Larvae finish maturation feeding by late June or early July and pupate in the crowns of trees where they form silken cocoons intertwined with foliage and branches.
- The full life cycle usually takes two years.

Siberian silk moth – *Dendrolimus sibiricus*

- Outbreaks of this moth are cyclic, occurring every 8 to 11 years following a few years of water shortage and last for 2 to 3 years.
- caterpillars have stinging hairs that can cause significant allergic reactions
- **Control measures:** aerial application of chemical and bacterial insecticides, using pheromone traps and applying appropriate control measures

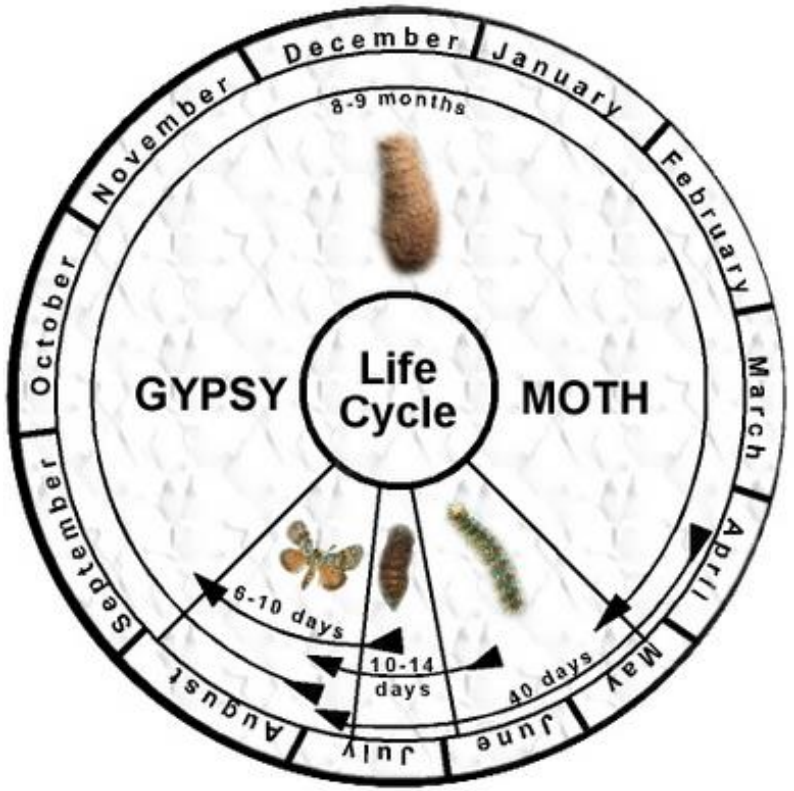
Siberian silk moth – *Dendrolimus sibiricus*

- Natural enemies of the Siberian caterpillar, including several parasitoids and pathogens, play an important role in the regulation of population density.
- Examples include the egg parasitoids *Telenomus gracilis, T. tetratomus*, and *Trichogramma dendrolimi*; the larval and pupal parasitoids *Ooencyrtus pinicolus* and *Rhogas dendrolimi*; the bacteria *Bacillus dendrolimus* and *B. thuringiensis*; the fungus *Beauveria bassiana*; and some viruses



Asian gypsy moth – *Lymantria dispar*

- On both broadleaf and conifer trees in naturally regenerated forests in China and Mongolia; Mongolia also reported the pest in planted forests of both host types.
- Host trees: many broadleaf and conifer trees, including *Betula, Larix, Populus, Pinus, Quercus, Salix,* and *Ulmus* species
- Video



Beehole borer – *Xyleutes ceramica*

- Major pest moth of teak, mostly occuring at the plantations
- Larvae are burrowing a long tunnel in the tree trunk called „beehole“, that leads to dieback
- **Control methods:** Since females lay their eggs mostly beneath the scales of bark, it is necessary to reduce such oviposition sites in trees. Conservation of the natural enemies, especially ants, is also important

Coffee carpenter– *Zeuzera coffeae*

- Moth that is problematic pest at wide rage of host trees: coffee, tea, cotton, coca and teak
- Their larvae bore into the stems or branches of the host plant
- It is a white moth with small black spots
- Larva and pupa are reddish brown in color.

Coffee carpenter– *Zeuzera coffeae*

- After larval attack, the crops can show many symptoms: branches and twigs wilt quickly then break off from plant. Holes are frequently visible from which the frass is exuded. Stems show dieback due to internal feeding and finally wilt, then the plant quickly dieback occurs.

Coffee carpenter– *Zeuzera coffeae*

- **Control methods:** adults and larva can hand picked and removed, immediately infestation is spotted; Planting barrier crops such as taro or sweet potato is used in many countries
- In biological control, many parasitoids and predators are used. To control larva, *Bracon zeuzerae*, larva of *Eulophonotus myrmeleon*, and *Pantorhytes* species are used. Woodpeckers are also effective.

Pantorhytes

Poplar clearwing borer – *Paranthrene tabaniformis*

- Breeding sources have to be carefully checked as moths are not easily visible
- Open galls or swellings appear on poplar stems
- Larvae have short legs and may be white yellowish in colour
- Eggs are laid in crevices and wounds, and larvae destroy first the cambial tissue around the entrance, causing swellings and necrotic change of stems
- Later, the larvae tunnel 6-8cm long into the core of the stem
- Pupal case is outside the exit hole in July.

Poplar clearwing borer – *Paranthrene tabaniformis*

- Noxious in forest nurseries and young poplar plantations
- The damage is stem breaking, but mainly on younger plants.
- Heavy attacks in nurseries can cause the loss of growing stock and possible risk of the spread of the pest into new plantations where the stem breaking continues
- Control and monitoring are necessary in the nursery when 5% of the stock is infested.
- For control mainly pheromones are used

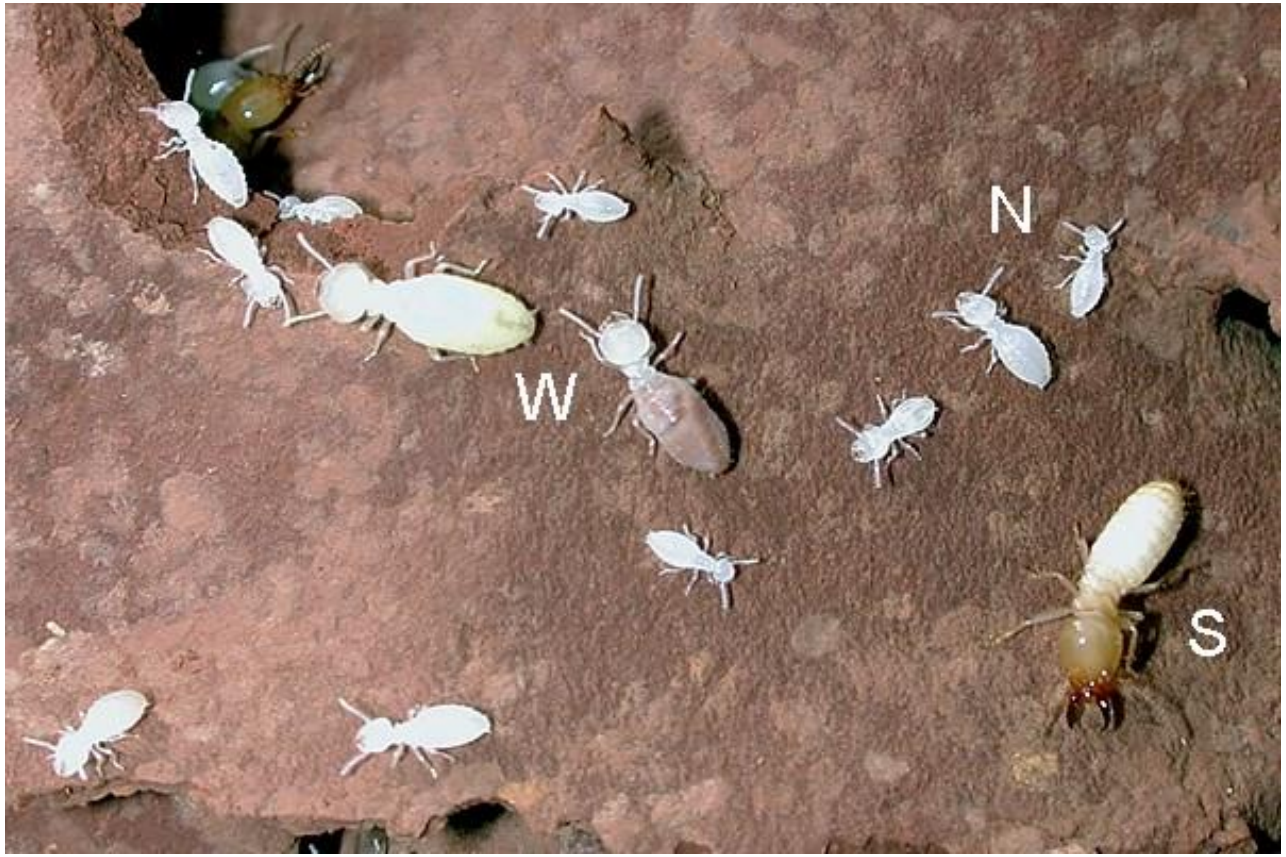
Poplar clearwing borer – *Paranthrene tabaniformis*

Rubber termite– *Coptotermes curvignathus*

- The pest often causing death of rubber trees in plantations
- Eggs are small, round and white and the nymphs are also white
- It is a social insect, living in colonies founded by an adult male (king) and female (queen)
- The workers are differentiated from the soldier caste in having paler head capsules and abdomens that are not as white.
- The soldiers have yellow head capsules, the mandibles of the soldier are also very strongly in-curved

Rubber termite– *Coptotermes curvignathus*

- W – workers
- N – nymphs
- S - soldiers



Rubber termite– *Coptotermes curvignathus*

- Often, large- to medium-sized trees are attacked, but plants with small wood stems are also attacked in plantations
- Host trees: *Pinus* spp., *Araucaria* spp. and *Agathis* spp.
- Although the termite attacks apparently healthy trees, attack is thought to be more likely when the bark is damaged by stem borers such as cerambycids and scolytids, or the fungal rotting
- **Monitoring:** by inspecting the tree trunk carefully, looking for signs of soil on the trunk and opening these to see if the termite is present; trees with stronger infestation starts to loose leaves and dieback can occur

Control

- **Biologic control:** field-derived cultures of *Conidiobolus coronatus* have been demonstrated to be highly pathogenic to *C. curvignathus*
- **Chemical control:** is the most commonly practiced method of control for *C. curvignathus*. Three general methods exist, that is the use of termiticides, chitin synthesis inhibitors and fumigants.

Green leaf hopper – *Cicadella viridis*

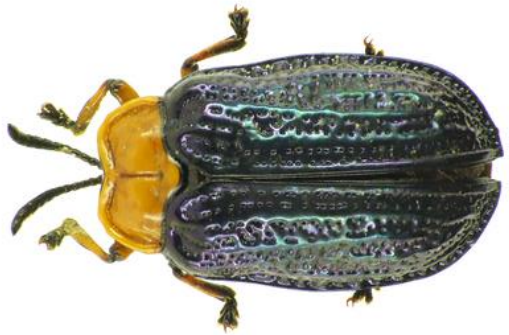
- Normally live on cereal grasses and other herbaceous plan
- Two generations are reported, the first thrive fully on crops, the second lay their eggs into the bark of poplar saplings, mainly in the lower position
- The eggs laid in late summer and early autumn, overwinter.
- Egg-clusters of 2-15 eggs can be found on every square centimetre of the smooth bark surface of the young plants.
- In spring the young larva, the nymph, moves to the herbaceous plants.

Green leaf hopper – *Cicadella viridis*

- The wound of the bark tissue creates a possible entrance for the weak pathogenic fungus *Valsa sordida (Cytospora chrysosperma*).
- The disease then causes a dieback of weak saplings or young plants. Resprouting is normal.
- For biological control are used predators and parasites and for chemical control pesticide application if needed

Gamar defoliator – *Calopepla leayana*

- Host tree: *Gmelina arborea* – Kashmir tree
- Normally causes damage to about one-third of the leaf surface area in natural conditions and in small plantations
- The early-instar larvae feed on the parenchyma-tissue, preferably on the undersurface of the leaves and make white patches on the leaf, which later turn brown
- It has three generations per year



Control

- **Mechanical:** hand collection of beetles, catching them by their attraction of white surfaces, destroying of hibernating
- **Biological:** The two most common parasitoids, *Brachymeria* and *Tetrastichus*, were considered to have potential, but they were unable to prevent the disastrous increase of defoliation in Myanmar.
- **Chemical control:** due to the variable regulations there is nothing recommended

Small velvet chafer – *Maladera orientalis*

- The damage by the beetle is more important than the injury on the roots of nursery stock or plantation trees by the grubs.
- Host trees: 150 plant species including poplar, willow, elm, and many fruit trees.
- The beetle has one generation and overwinters in the soil
- It feeds on buds and tender leaves in May and June.

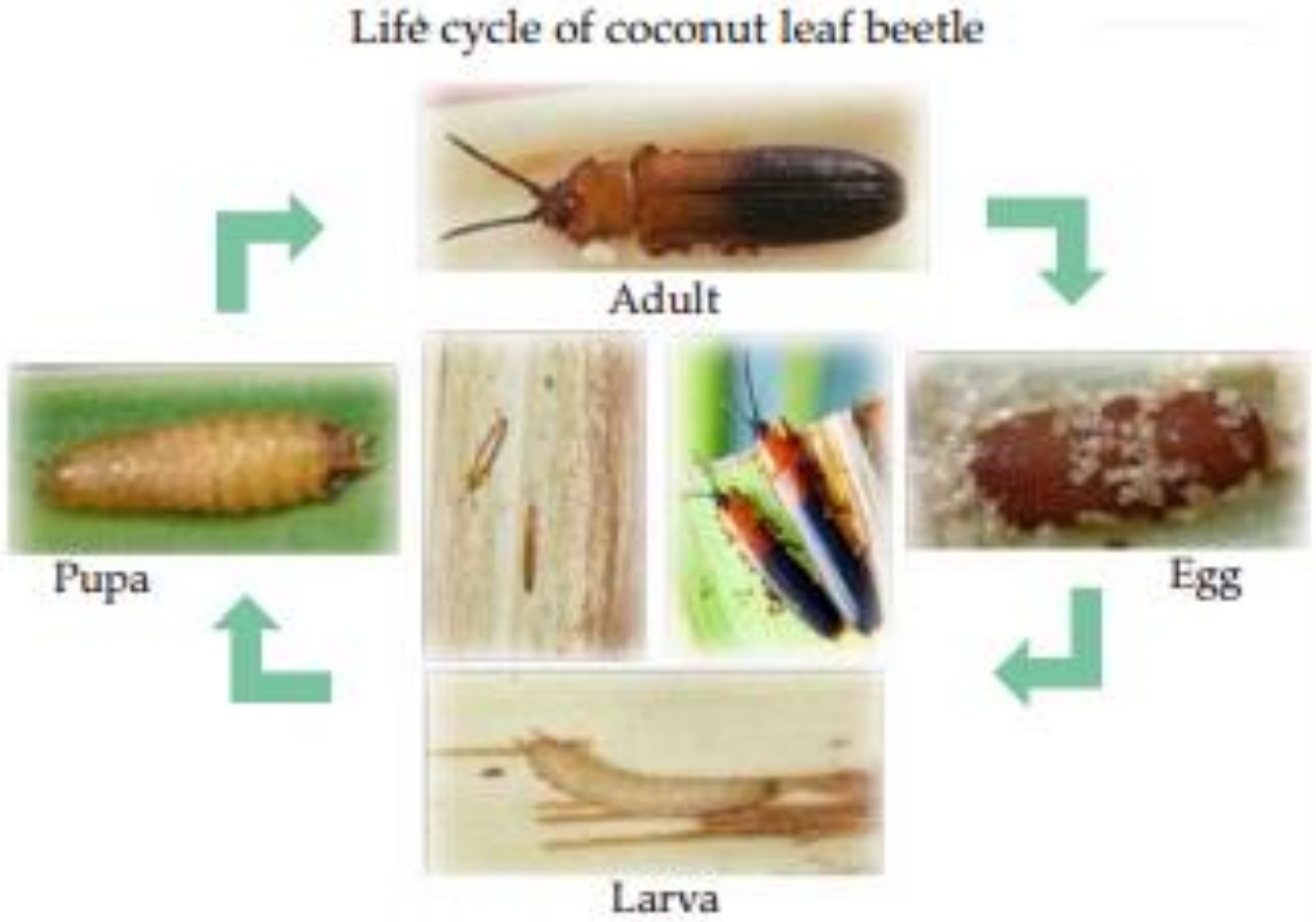
Small velvet chafer – *Maladera orientalis*

- Under heavy attack, forest nursery stock loses buds and leaves in spring.
- Effective chemical control methods of this insect are discussed.

Coconut leaf beetle – *Brontispa longissima*

- One of the most damaging pests of coconut and other palms
- The larvae and adults of the beetle feed on the soft tissues of the youngest leaf in the throat of the palm.
- Affected leaves dry up, resulting in stunting of the palm and reduced nut production.

Coconut leaf beetle– *Brontispa longissima*

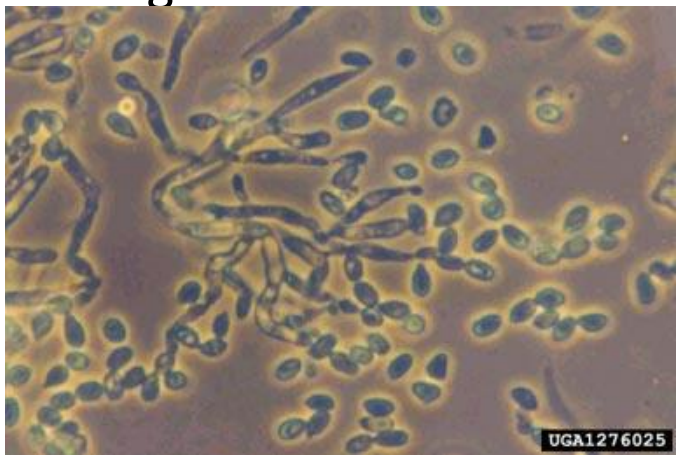


Coconut leaf beetle– *Brontispa longissima*

- The larvae and adults are nocturnal in habit and remain in the unopened leaflets, moving outside only to infest nearby palms or for mating.
- Larvae undergo four to six larval instars in a period of 30 - 50 days.
- Larvae chew on large areas of the surface of leaflets still in the throat of the palm (the spear leaf), which causes the death of underlying tissues.
- Such leaflets show long white streaks. As the leaf emerges, the leaflets curl and turn brown, giving a characteristic scorched and ragged appearance and photosynthesis is reduced to zero in affected leaflets.

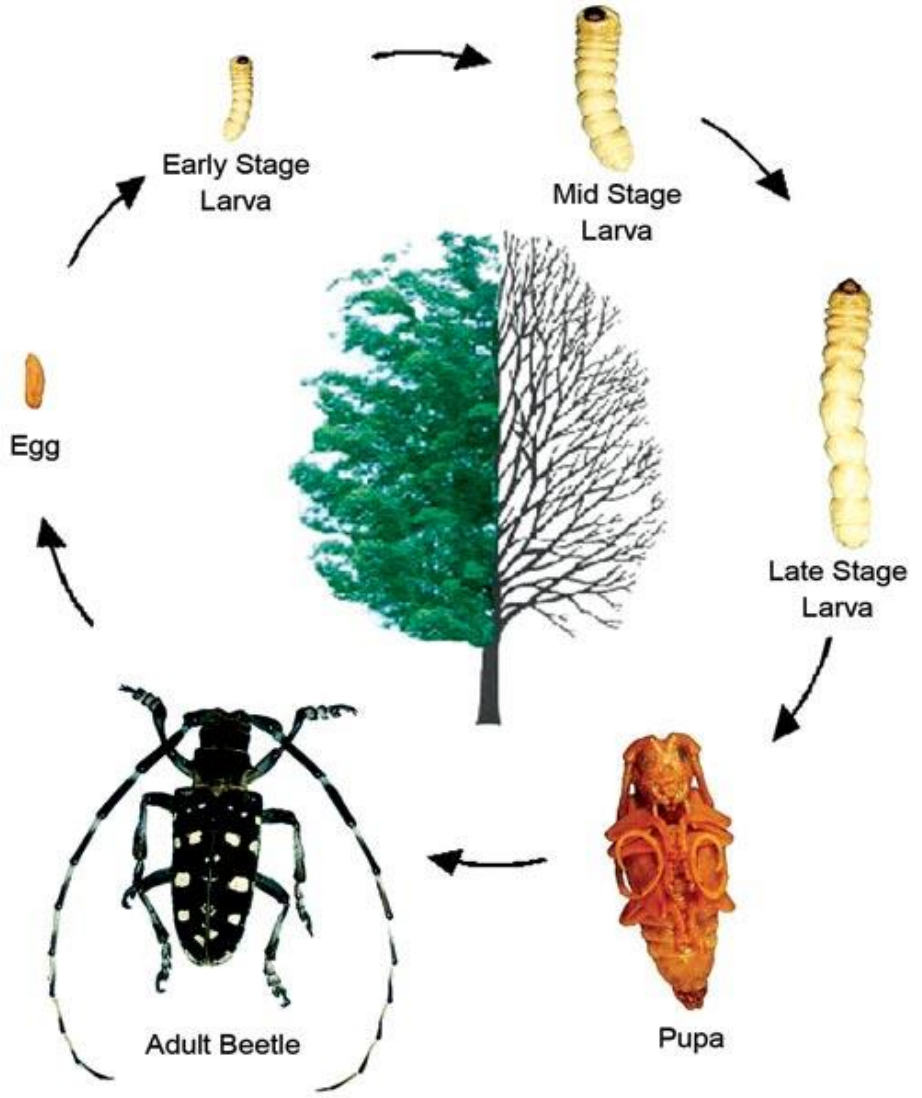
Control

- **Mechanical**: Blockading and cutting of coconut palms up to three kilometers from the infestation spot. The pest is also controlled by pruning, clean culture and proper disposal of infested palms
- **Chemical**: Several insecticides are being used to control the coconut leaf beetle. Some insecticides are also injected in to the trunk of infested palms. However, the effect of these treatments lasts only for 3-4 months
- **Biological**: Two parasitoids of coconut leaf beetle, *Tetrastichus brontispae* and *Asecodes hispinarum*, have been successfully used in several countries to control the beetle. Use of the entomopathogenic fungus *Metarrhizium anisopliae* is also promising.



Asian longhorned beetle – *Anoplophora glabripennis*

- Host treed: poplar, willow elm and maple
- Larvae, legless and white in colour, reaching up to 7 cm length.
- Beetles are found in summer and autumn, leaving the tree through a one cm wide, circular exit hole
- 🐞🐞 gnaw an oval egg niche in the bark on the branches or stem.
- One generation per year
- Beetles are not flight active



Symptoms and control

- Coarse fibrous frass on trunk is an indication of attack.
- Larvae can easily destroy the woody parts of the tree
- Timber gets reddish—brown stains, branches die first and thereafter the main parts of the tree
- **Control:** looking for exit holes, traps with pheromone, removing infested trees, using of insects, using of fungi to increase larvae mortality in China (but most countries dont use biological control)

Apodemus

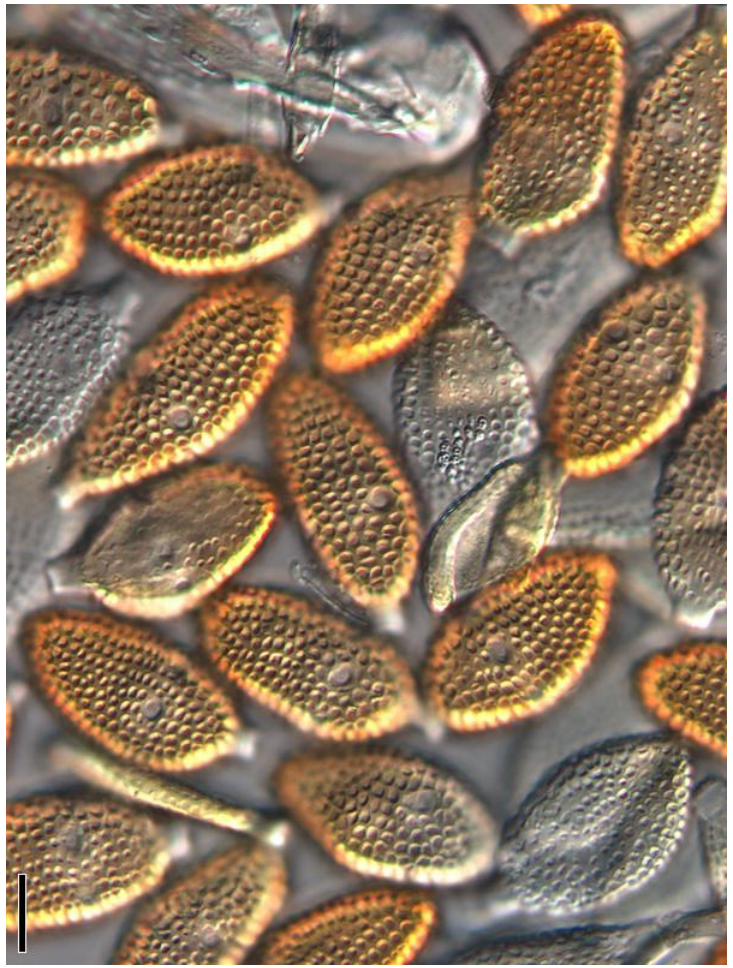
- Genus which contains the Eurasian field mice
- They are highly variable in size and color
- They are primarily seed eaters – they carry them back to the nests for storrage, but they can also eat small roots, snails and insects

- Mainly active during the dark and they are very good climbers
- Female can have more than one litter per year and there should be 4-8 mice pups

Apodemus

- They can eat so many seeds, so the new population of the trees can be reduced
- The biggest plantation problem is, that they eat and dig under the roots of the young planted trees, so destroying the access to water and nutrients leads to dieback and big economic problems

Asian forest diseases



Phyllode rust - *Endoraecium digitatum*

- Host trees: a wide range of (sub) tropical acacias, for example *Acacia aulacocarpa*, *A. auriculiformis*, *A. crassicarpa*, *A. koa*, *A. leptocarpa*, *A. mearnsii*, *A. mangium* and *A. polystachya* (Fabaceae).
- Distribution: Australia, Papua New Guinea, China, Hawaii, Indonesia, New Zealand.

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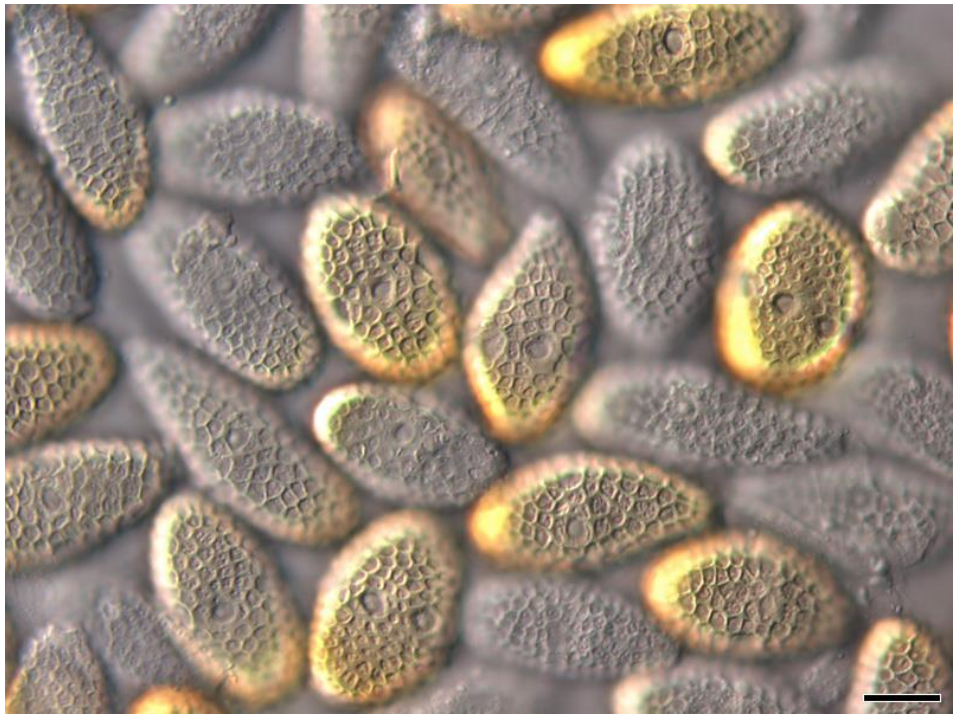
Phyllode rust - *Endoraecium digitatum*

- **Symptoms:** Infected phyllodes, shoot tips, petioles and even fruits of infected trees may suffer gross malformation, or more orderly cell proliferation in the form of galls or blister-like swellings.



- When the growing points of young trees are infected, the rust causes extreme swelling (hypertrophy) of the apical meristem and death of leading shoots with consequent loss of stem form.

Management

- Control of the pathogen in nurseries will be readily achieved using appropriate application of systemic fungicides.
- Systemic fungicides such as Baycor® (bitertanol) and Plantvax® (oxycarboxin), effective against other rust fungi, are likely to be useful.

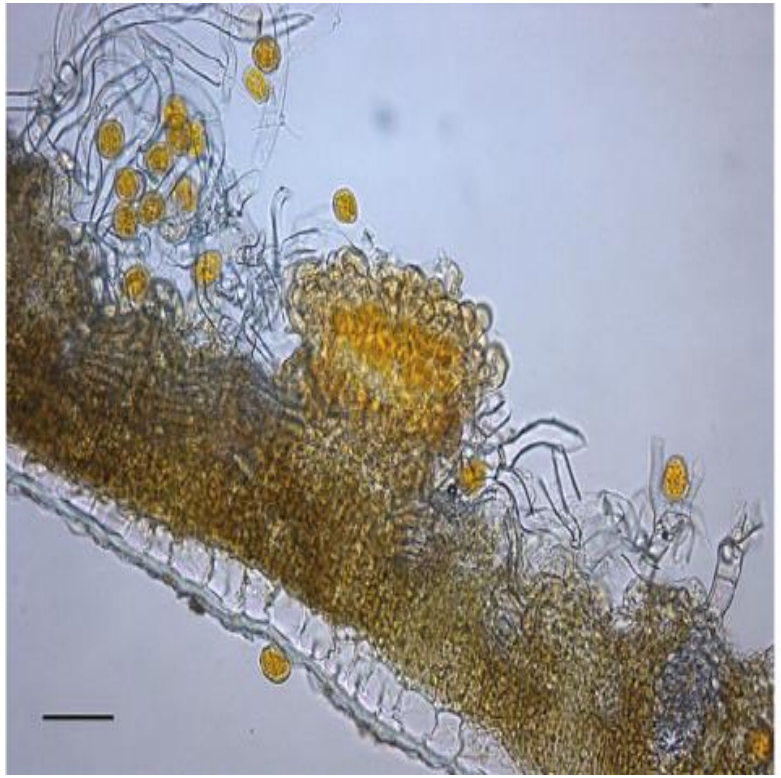
teliospore with finger-like apical protrusions, giving the fungus its name.

Leaf rust - *Olivea tectonae*

- Host tree: *Tectona grandis*
- Distribution: Asia (India, Pakistan, Ceylon, Taiwan, Burma), South and Central America (Panama, Costa Rica, Mexico, Ecuador, Cuba) and Australia

Symptoms

- Orange coloured scattered uredial and telial sori on the abaxial leaf surface
- Yellowish brown fruiting bodies of the fungus.



Control

- The infected seedlings can be segregated and kept in isolation.
- Severely infected and dead seedlings should be burnt to prevent the spread of the disease.
- The disease may be controlled in the nursery by the application of sulphur based fungicide (Sulfax) on both sides of the leaves.