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Urban Forest Insect Pests and Their Management in Malaysia

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ABSTRACT

Urban forestry is an increasingly important field in Malaysia due to the greening efforts made by the government since 1997. Despite this, little is known about the insect pests affecting urban trees in Malaysia. This paper describes the common urban forest insect pests of Malaysia, the damages they cause, and the control methods commonly used against them.

Key words: urban forest, insect pest, Malaysia

Introduction

The greening of urban Malaysia has primarily been focused on beautification of the urban landscape by horticulturists, landscapers, nursery workers, town planners, and architects, with minimal inputs from foresters. Because of this, very rarely is the term urban forestry being used (Sreetheran *et al*., 2011). The first records of urban tree planting in Malaysia were in 1778 in Malacca (Koening, 1894) and in 1802 in Penang (Burkill, 1966), where the Malay Paduak, *Pterocarpus indicus*, was planted. Because of its beauty and the ease of propagation, it was a popular tree for urban planting in Malaysia and Singapore until the 1990s (Sanderson *et al*., 1997; Philip, 1999). However, the popularity of this species declined after the trees became infected with Fusarium vascular wilt (*Fusarium oxysporum*). Currently, other indigenous or exotic species in Malaysia are replacing this species in urban planting programs.

In 1997, a nationwide tree planting program with the objectives of making Malaysia a garden nation was initiated (Nordin, 1997). With the support of city dwellers, private sectors, and government agencies, more than 400,000 trees and 6 million shrubs were planted (Sreetheran *et al.*, 2011). Trees were also grown as screens to protect against traffic dust and noise and to provide a nice view for people living next to motorways (Salleh *et al*., 1990). Although the target of increasing tree number was reached, little was done to nurture and maintain the trees after they were planted. Regular tree inspection was often not performed, and insect pest problems and diseases were often not

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Table 1. Important pests of urban forests in Malaysia

Types of pests	Order	Family	Species
Trunks and roots	Blattodea	Rhinotermitidae	*Coptotermes gestroi*
			Coptotermes curvignathus
		Termitidae	*Macrotermes gilvus*
	Coleoptera	Cerambycidae	*Xystrocera festiva*
		Scarabaeidae	*Oryctes rhinoceros*
	Lepidoptera	Cossidae	*Squamura disciplaga*
Leaves	Orthoptera	Acrididae	*Valanga nigricornis*
	Lepidoptera	Papilionidae	*Chilasa clytia clytia*
		Hesperiidae	*Hasora cromus cromus*
		Lymantriidae	*Orgyia postica*
		Psychidae	*Pteroma pendula*
			Mahasena corbetti
			Metisa plana
			Pagodiella hekmeyeri
		Saturniidae	*Attacus atlas*
		Pyralidae	*Paliga damastesalis*
			Sylepta derogata
		Gracillariidae	*Neolithocolletis pentadesma*
	Coleoptera	Scarabaeidae	*Apogonia* sp.
		Curculionidae	*Hypomeces squamosus*
		Buprestidae	*Trachys* sp.
		Chrysomelidae	*Brontispa longgisima*
Sap suckers	Thysanoptera	Phlaeothripidae	*Gynakothrips* sp.
	Hemiptera	Coreidae	*Mictis longicornis*
		Aleyrodidae	*Aleurodicus disperus*
		Pseudococcidae	*Rastrococcus* sp.
Gall makers	Hemiptera	Psyllidae	*Megatrioza vitiensis*
	Hymenoptera	Eulophidae	*Quadrastichus erythrinae*
	Acarina	Eriophyidae	*Eriophyes doctersi*

noticeable until the infestation became serious.

In this paper, I describe the common insect pests of urban trees in Malaysia and the problems that they cause. In addition, the common control approaches used against these insect pests in Malaysia are described.

Pests of urban trees in Malaysia and the damage they cause

A total of 28 species of insect and one species of acarine, covering 24 families and 8 orders, are commonly occurring pests of urban forests in Malaysia (Table 1). The damage they cause can be divided into damage to 1) trunks, branches, and roots, 2) leaves, and 3) shoots and 4) loss of aesthetics due to the presence of the insects (Sajap, 2009).

Pests attacking tree trunks, branches, and roots

Subterranean termites are the primary pests of urban forests in Malaysia (Lee, 2007). Two species of termites, namely *Coptotermes curvignathus* and *C. gestroi*, are highly destructive to urban trees

Table 2. Prevalence of termite infestations among different tree species in a university campus in Penang, Malaysia

Species	No. inspected	% infested
Acacia mangium	16	87.5
Casuarina equisetifolia	13	84.6
Fagraea fragrans	13	84.6
Araucaria excelsa	12	75.0
Tabebuia sp.	13	69.2
Albizia saman	76	61.8
Pterocarpus indicus	47	61.7
Swietenia sp.	32	60.0
Delonix regia	35	57.1
Araucaria cunninghamii	11	54.5
Pongamia pinnata	30	50.0

(Cowie *et al.*, 1989). Normally, the damage caused by termites can be detected by the presence of mud tubes on the trunks of trees that have been attacked. Termites usually feed from the base of the tree leading to the inner side of the trunk, ultimately hollowing the tree and causing it to be structurally weakened. Newly attacked trees normally have leaves that are turning yellow and dropping. In ornamental palm trees, termites normally attack the spear region of the palm, and once the spear is destroyed, the tree dies because the spear is the growing vegetative part of the palm (UNEP, 2000). Another species of subterranean termite that attacks urban trees is *Macrotermes gilvus*. Normally, the damage it causes is limited to the tree bark; very rarely it will attack the inner trunk of mature live trees. Among the tree species planted on a university campus in Malaysia, the prevalence of termite infestations was found to vary with tree species (Table 2). Thus, some trees species are more susceptible to termite attack than others (Lee, 2009).

Xystrocera festiva is a longhorn beetle regularly found attacking moluca (peacock plume) and acacia trees in urban areas of Malaysia. The brown colored adult insect is between 35 and 40 mm long. The initial attack of this insect pest can be detected by the presence of spotted sticky sap on the trunk that will eventually darken. The holes bored by the beetle are filled with wood debris and insect frass. The branches attacked by these beetles break easily, and infested trees eventually die.

Squamura disciplaga, a lepidopteran, is a major pest of shade trees such as casuarina, purple millettia, and Madras thorn. The larva bores into the trunk and feeds on the tree bark. It subsequently constructs galleries for protection using its silk, wood debris, and frass. Pupation occurs in the hole, and the pupa can be partially seen hanging out from the bored trunk. Unhealthy trees often experience additional microbial infections due to the holes bored by the insects.

Another important insect pest is the rhinoceros beetle, *Oryctes rhinoceros*. It is a large black beetle that often attacks urban palm trees. These beetles attack the developing fronds of the palm, move into the trunk, and then feed from the inside. Damaged fronds show triangular cuts. The larvae do not damage the trunk, although they do grow in the dead decaying trunk.

Pests attacking leaves

The pests that attack tree leaves are predominantly lepidopterans and coleopterans. In general, they are leaf miners, leaf

feeders, leaf-borers, leaf-curlers, or gall makers.

Bag worms (*Pteroma pendula*, *Metisa plana*, *Mahasena corbetti*, and *Pagodiella hekmeyeri*) are serious pests of ornamental urban palm trees in Malaysia such as the Manila palm and Macarthur palm. The biology of *P. pendula* is relatively unique. The adult female is apterous and vermiform like and spends its entire adulthood in the cocoon. The grey-colored adult male moth has a non-functional mouthpart. Palm leaves attacked by *P. pendula* looked rusty and often have pupae hanging below the leaves. Infestation often leads to loss of aesthetics and the shade characteristic of the palm trees. The damage caused by *M. plana* resembles that caused by *P. pendula*. The larvae of *M. plana* pupate in cocoons that are ~15 mm in length and are stuck to the leaf at an angle. *M. plana* also attacks other important urban trees such as purple millettia, moluca, acacia, and penaga lilin (*Mesua ferrea*).

The Atlas moth, *Attacus atlas* (L.), is the world's largest moth, with a wing span of up to 250 mm. It often feeds on young leaves of urban trees until the trees become leafless. Its common host trees are African mahogany, *Cinnamomum* spp., other species of amenity trees, and fruit trees (e.g., rambutan, guava, star fruit, and soursop) found in urban areas. Its caterpillar can reach 150 mm in length. The frass of the larvae can be spotted under infested trees.

Small pyralid moths, such as *Paliga damastesalis* and *Sylepta derogate*, are also pests of urban trees. *P. damastesalis* larvae feed on the leaf tissue of teak, often causing the leaves to turn brown and leaving only the veins. *S. derogata* larvae curl the leaves of *Erythrina* sp. and feed from inside. *Neolithocolletis pentadesma* is a small gracillariid moth whose larvae mine the leaves of moluca and other urban trees, creating a spotted membrane underneath the leaves. Repeated attacks by this species can cause premature defoliation and lead to the death of branches. *Chilasa clytia clytia* larvae feed freely on the young leaves of *Cinnamomum* trees, especially newly planted ones, and can eventually lead to the death of the trees. *Hasora cromus cromus* larvae feed on the leaves of Indian beech (*Pongamia pinnata*).

There are several beetle species that attack leaves of urban trees. Adult scarab beetles, *Apogonia* sp., feed on the leaves of purple millettia, Bengal almond, moluca, and Indian beech and create holes in the leaves. Its larvae live in the soil and feed on grass roots and other small plants. The adults stay in the soil during the day and feed on leaves at night. The weevil, *Hypomeces squamosus*, feeds freely on the leaves of moluca, acacia, *Cinnamomum* spp., and yellow jade orchid tree (*Magnolia champaca*). Just like *Apogonia*, its larvae live in the soil and feed on grass roots. Buprestid larvae of the leaf miner, *Trachys* sp., feed on leaf tissue of urban shade trees such as Indian beech, causing the leaves to look spotty brown. The adult beetle then feeds on the entire leaf, except the hard veins. The chrysomelid *Brontispa longisima* attacks palm trees (such as betel nut and imperial palm) by feeding on their leaf tissues. The fronds of the palm turn brown and gradually become dry.

The locust *Valanga nigricornis* also feeds on amenity trees and attacks plants in nurseries and newly planted trees. However, it is not a major insect pest of urban trees in Malaysia.

Sapsuckers

Sapsuckers are insects with piercing/sucking mouthparts. Four pest species from the order Thysanoptera and Hemiptera are commonly found attacking urban trees in Malaysia. Besides causing injury to the trees, these pests can also serve as vectors of plant viruses.

The thrip, *Gynakothrips* sp., which measures 0.5 mm long, often attacks

shade trees from the genus *Ficus*. Affected leaves are often twisted, spotted, and dark brown in color. The coreid bug, *Mictis longicornis*, sucks the sap from young shoots. When disturbed, it releases a pungent liquid that irritates the eyes. The whitefly, *Aleurodicus disperus*, feeds by tapping into the phloem of plants, introducing toxic saliva and decreasing the plants' overall turgor pressure. The mealybug, *Rastrococcus* sp., attacks many species of urban trees including *Plumeria*. The honeydew of the bug causes the leaves to turn dark and become covered by a layer of soot, which decreases the aesthetics of the trees.

Gall makers

Three species of pests in Malaysia are known to attack the meristematic plant tissues of urban trees causing unusual deformations known as galls. The leaf hopper, *Megatrioza vitiensis*, normally causes galls on *Eugenia papillose*, *Cinnamomum* spp., and Indian rose chestnut trees. Eggs are laid under the leaf, and the nymphs suck the leaf sap. This causes the upper surface of the leaf to form a gall. Erythrina gall wasp (*Quadrastichus erythrinae*) is an important gall-making insect on coral trees in Malaysia such as *Erythrina variegata*, *Erythrina crista-galli* and *Erythrina glauca*. The midge-like adult wasp will insert their eggs into young leaves and stem tissues. Wasp larvae hatch and develop in plant tissues inducing gall formation. Normally there is a wasp per gall cell, but could be more under heavy infestation. Larvae pupate within the gall, and the adults emerge by cutting exit holes through the galls. The other species is an acarine, *Eriophyes doctersi* that normally attacks the leaves of *Cinnamomum iners*.

Control of pests of urban forests in Malaysia

Chemical control remains the most common method used against pests of urban forests in Malaysia (Sajap, 2009). Table 3 provides a summary of the common control methods used. Trees infested with subterranean termites such as *C. gestroi* and *C. curvignathus* are normally drenched with insecticide (e.g., chlorpyrifos, fipronil, and imidacloprid). Before drenching, the mud tubes are removed from the trunk and a trench is dug along the base of the tree. Bait can also be used against these two species. For example, in one study in-ground termite monitoring stations were installed, and when the stations became infested, termite baits containing a chitin synthesis inhibitor (e.g., hexaflumuron, chlorfluazuron, and bistrifluron) were placed in the infested stations (Lee, 2001). For higher termites such as *M. gilvus*, mounds are located and excavated and the remains are drenched with a pyrethroid. For beetle pests attacking tree trunks, imidacloprid and azadirachtin can be injected into the trunks. However, trees that are seriously infested are destroyed to avoid further infestation of other healthy trees. For the rhinoceros beetle, the fungal agent *Metarhizium anisopliae* can be applied to the piles of infested trunks. To manage *S. disciplaga*, dimethoate or fenitrothion are injected into the hole bored by the insect pest.

When controlling lepidopteran pests attacking leaves, the systematic insecticide carbofuran and chemical sprays often are used. Systemic insecticides have proven to be effective against bagworms such as *P. pendula* and *M. plana*. Microbial agents such as *Bacillus thuringiensis* can also be used through application into the affected trees. Injection of tree branches with monocrotophos can also be used to manage bagworms. To manage coleopteran pests attacking leaves, leaves often are sprayed with pyrethroid and organophosphate sprays. Chlorpyrifos can be used to control insect larvae in the soil.

Table 3. Common control methods used against pests of urban forests in Malaysia

Species	Treatment option	
	Chemical/others	Biological
Coptotermes gestroi	Drenching, termite baiting	–
Coptotermes curvignathus	Drenching, termite baiting	–
Macrotermes gilvus	Excavation of mound and drenching	–
Xystrocera festiva	Chemical injection into the trunk	–
Oryctes rhinoceros	Pheromonal trap, chemical injection	*Metarhizium* spray
Squamura disciplaga	Chemical injection into the trunk	–
Valanga nigricornis	Malathion, methamidophos or monocrotophos sprays	–
Chilasa clytia clytia	Abamectin spray	Bt spray
Hasora cromus cromus		Bt spray
Orgyia postica		Bt spray
Pteroma pendula	Systemic insecticide carbofuran	Bt spray
Mahasena corbetti	Systemic insecticide carbofuran	Bt spray
Metisa plana	Systemic insecticide carbofuran	Bt spray
Pagodiella hekmeyeri	Acephate spray	–
Attacus atlas	Malathion or cypermethrin sprays	Bt spray
Paliga damastesalis		Bt spray
Sylepta derogata	Permethrin or carbaryl sprays	–
Neolithocolletis pentadesma	Injection of acephate	–
Apogonia sp.	Light trap, cypermethrin, or trichlorfon sprays on leaves, chlopyrifos on soil	–
Hypomeces squamosus	Acephate, carbaryl or methamidophos sprays	–
Trachys sp.	Pyrethroid sprays	–
Brontispa longgisima	Systemic insecticide such as carbofuran	–
Gynakothrips sp.	Removal of affected branches, and deltamethrin or fipronil sprays	–
Mictis longicornis	Acephate or dimethoate sprays	–
Aleurodicus disperus	Removal of affected leaves, white oil, profenofos or imidacloprid sprays.	–
Rastrococcus sp.	Removal of affected leaves, white oil or malathion sprays	–
Megatrioza vitiensis	Imidacloprid, malathion, permethrin, spinosad sprays	–
Quadrastichus erythrinae	Foliar application of dimethoate, imidacloprid, fipronil and cypermethrin.	
Eriophyes doctersi	Imidacloprid, malathion, permethrin, spinosad sprays	–

To treat infestation with sapsuckers, affected branches and leaves are removed before the application of insecticides (e.g., deltamethrin, fipronil, acephate, dimethoate, profenofos, and imidacloprid). White oil can be used against mealybugs and whiteflies. Lastly, foliar sprays (dimethoate, imidacloprid, malathion, permethrin, and spinosad) applied to affected leaves often are used against gall makers.

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馬來西亞的都市林害蟲和管理

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摘　要

由於自 1997 年起馬來西亞政府致力於綠化，都市林領域愈來愈重要；但有關為害馬來西亞都市林的害蟲資料不多。本文記述馬來西亞都市林常見害蟲、造成的損害及常用的防治方法。

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