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題　目：Urban Pest Management in South East Asia - Changing Trends, Current and Future Perspectives
（東南アジアにおける都市害虫管理の現在と未来）

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要　旨：
The rapid urbanization in South East Asia due to accelerating socioeconomic growth has brought major demographic changes to urban cities in that region. Although it has also led to comfortable and better life quality to the urbanites, population growth has outstripped improvements in infra-structural development such as housing, water, drainage, waste disposal facilities, etc. The most common problem experienced in these urban cities is the emergence of slums and squatters. United Nation Human Settlements Program had estimated that in 2003, some 550 million people live in urban slums in Asia, which accounted for 60% of the world's slum residents. Slums are excellent breeding grounds for many urban pests of public health importance.

Traditionally (prior to 1980s), urban pest management activity in South East Asia concentrated on managing pests of medical importance such as mosquitoes, flies, cockroaches, rodents, and pests of economic importance such as termites. Mosquitoes and flies were normally managed by local municipalities and health departments in each state or provinces, while the management of other pests were carried out by private pest management companies. Cockroaches were normally controlled with residual insecticides, while subterranean termite control concentrated on the use of soil termiticides and dust. In the late 1980s, extensive problems of insecticide resistance (to carbamate insecticides) were discovered in field populations of the German cockroach, following by major pyrethroid resistance in the mid 1990s. The introduction of cockroach gel baits containing hydramethylnon, imidacloprid and fipronil in the late 1990s has helped to effectively overcome the cockroach resistance. However, this led to two other pest issues. Glucose aversion was found in some field populations of the

German cockroach, and more recently bait aversion was also detected. In addition, because traditionally, residual spray was used to manage cockroaches (and in-directly other crawling insects as well) and the use of cockroach bait now is very target-specific, the decreased use of residual sprays has resulted in emergence of other crawling insect pests such as ants and bed bugs.

Ant management is difficult due to its diverse feeding habits among the different ant species. Some species are also capable of 'budding' to establish new colonies when they are affected by selected residual insecticides. Furthermore, residual sprays against foraging ants only killed a small fraction of the entire colony (10-30%). Baits are often seen as a better option because it can cause colony elimination. However, the key to effective baiting is to ensure a good amount of baits are taken and consumed by the ants, and this would not be possible without an effective and palatable ant bait. This has thus led to extensive studies on feeding and foraging behaviour of pest ants. Because of numerous pest ant species and diverse feeding habits, a bait that is acceptable and palatable by all ant species has yet to be discovered and very likely will.

The shift from premise-wide use of broad spectrum insecticides to more selective control tactics such as baits, along with other factors such as increased travel, increased exchanged of second-hand furniture and insecticide resistance have led to increasing importance of bed bugs. Traditionally, bed bugs were known as a pest problem associated to poor nations. Now, it is gradually becoming a global problem. Bed bugs used to be a pest issue in cinemas and old living quarters in rural areas in South East Asia between 1940s and 1970s. However, over the last several years, pest management companies have recorded a surge in bed bug accounts, and mostly in urban residential premises and major hotels and resorts. So far, the management tactics against bed bugs are still relatively ineffective, and the pyrethroid resistance issue further aggravates control failures.

Subterranean termite management in South East Asia was revolutionized with the introduction of termite baits in late 1990s. Termite bait was viewed as a more environmentally-acceptable alternative to soil termiticide which requires drilling of floors and injection of chemicals into the soil. Within several years, it commands 20% of all termite management business in Malaysia. Bait is highly effective against important termite species in such as those from the genus of *Coptotermes*, particularly against *Coptotermes gestroi* and *Coptotermes curvignathus*. Several issues associated

with termite baiting include disturbance trauma on foraging termites during baiting process, necrophobic behaviour in termites and invasion of other invertebrates into bait monitoring stations. Bait is not a silver-bullet either to all subterranean termite infestations, as it is only effective against lower termites (Rhinotermitids). In addition, upon elimination of the lower termite species, the premises may be re-infested again by a higher termite species such as *Macrotermes gilvus*, *Microcerotermes crassus* and *Globitermes sulphureus*, which it is ineffective against.

The future trend in urban pest management draws towards more target-specific approaches. However, several major underlying issues warrant immediate investigations, namely cockroach bait aversion, effective bed bug management tactics, succession of secondary termite species and bait efficacy against them, diverse ant feeding behaviours, etc.