The Newsletter | No.66 | Winter 2013

Termites and human society in Southeast Asia

Termites are ubiquitous across the world and have widespread beneficial impacts on ecological communities and ecosystem processes. Crop yields increase parallel to the richness of termite species in any given farmland and this is in no small part through the inestimable services termites offer to ecosystems and the role they play as socioeconomic drivers. Long reciprocal interactions have taken place between human society and termites. Yet how they have fundamentally shaped the integrity of our environments, socioeconomic base, and the livelihoods of millions in Southeast Asia today, tends to be ignored. This short essay introduces their role in the eco-systems of Southeast Asia to argue that they should be appraised in any future policies toward the region's agro-landscape and their invaluable interactions in the humanosphere.

Kok-Boon Neoh

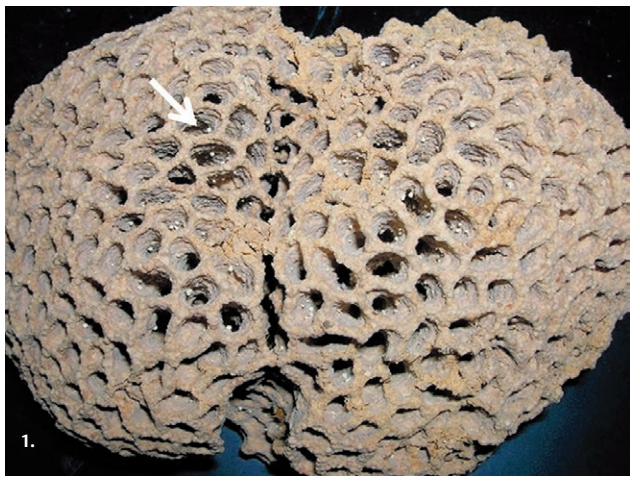

Fig. 1: Termites deposit their food materials as a honeycomb-like structure. The termites cultivate symbiont fungus *(Termitomyces spp.)*, but maintain them in a nodul stage (see arrow). The fungus is essential to degrade plant-derived toxin and provide proteinous nutrient to the young termites.

Fig. 2: The fruiting body of the termite mushroom is well known as a local delicacy in Thailand, Myanmar and Vietnam.

Fig. 3: Indonesia consists of 22.5 million hectares of peat swamp forest that accounts for 5% of global peat lands. Large peat swamp areas are degraded annually due to improper management and wild fires. Under such conditions, where earthworms are absent from highly acidic and disturbed areas, termites offer valuable ecosystem services.

Fig. 4: A queen termite can become as large as 7 cm in length and contain more than 50% unsaturated fats, proteins, minerals and vitamins that are essential to human health. Superstitiously, it is also believed that consuming a raw queen termite can boost male sexual prowess.

KNOWN AS THE 'WHITE ANT', termites are believed to have existed on the earth long before any other social insects.[1] Studies of fossils in petrified forests in Arizona have suggested that they existed in the Permian period as far back as 220 million years ago. In other words, they are one of the oldest creatures on our planet and witnessed the rise and demise of the dinosaurs. Termites cover 70% of the world's habitable surface and are found predominantly in tropical and sub-tropical regions or areas that are close to the equator.[2] There are over 2,600 described species, comprising a total of 281 genera. Today, the evidence from phylogenetic and morpho-logical studies strongly suggest that termites are eusocial[3] cockroaches and are now classified within the cockroach family *(f. Blattodea)*. This indicates that termites might have evolved from a single 'social cockroach' species, which then diversified into a number of termite families.

Natural ecosystem service providers

Termites are considered to be one of the most beneficial insect groups in natural ecosystems and they are what we can call, typical agro-ecosystem engineers. They are cellulose-based feeders; they feed on a wide array of food ranging from living plant tissue, wood and roots, plant litter and humus in varying degrees of decay. They are essential for the energy flow and recycling of nutrients in the natural environment and are also great modifiers of soil porosity, its water holding capacity, as well as soil water infiltration rates. Termites also enhance soil quality and nutrients such as pH, water content, organic carbon and nitrogen, as well as modifying soil compo-sition via relocating the soil particles during mound construc-tion. Their overall effect in terms of activities influences the composition and spatial arrangement of plant diversity, while their mounds provide a specific microhabitat that enhances the growth and survival of certain tree species. This role can't be emphasized enough in the highly eco-diverse Southeast Asian tropical rain forests. Crucially, through their services to ecosystems, they play a role as socioeconomic drivers for human societies. In other words, there is increasing evidence that shows that *crop yields increase parallel to the richness of termite species in any given farmland.*[4]

Termites and the Southeast Asian food chain

Termites are also a part of our food chain and contain nutrients that are essential to the human diet. They range from queens, soldiers, winged termites and edible termite mushrooms. In other regions, such as Africa and some parts of Latin America, they are an important protein source and Southeast Asia is no exception. Both Thailand and Myanmar are renowned for their wild termite mushrooms *(Termitomyces fuliginosus),* in Thai also known as *Het Khone*. Termites of the family *Macrotermitinae* (macrotermitids) are generally detrivores, i.e., they feed mainly on dead wood, dead grass, dung, and the roots of dead or living plants. By doing so, they turn their food into a fungus comb and cultivate a symbiotic fungus (genus *Termitomyces*) inside their nests. This mushroom serves as a protein source for young termites and helps in degrading the toxic plant-derived compound *(lignin)* in their food. During the monsoon seasons, these mushrooms emerge as a fruiting body in termite nests.[5] In the region, these seasonal mushrooms are appraised as a delicacy and are expensive. During this period, *Yum Hed Khone* (Spicy termite mushroom salad) can cost up to THB 350 (US$12).

If we turn to the southwestern provinces of Vietnam, such as Ben Tre or Tien Giang, the local people roast termite mushrooms with betel leaves. The price of one kilo of termite mushroom in Tien Giang can cost up to 300,000 VND per kg ($15). However, these consumption activities vary within the region. Wild termite mushroom dishes or termites themselves are rarely served in Malaysia, although middle-aged men do have a predilection for queen termites, which are highly sought after. Local indigenous knowledge treats queen termites as an aphrodisiac; they are thought to have special properties similar to that of Viagra and can boost male sexual prowess. Queens are usually swallowed alive before sex to boost performance. Superstitious beliefs can hike the price of queen termites up to an astonishing $1500 based on their color and vitality (doctors reject these effects as nothing more than a placebo effect).

The ritual ant

Aside from their ecological services, nutritional value and perceived aphrodisiacal qualities, termites can have ritual significance in some Southeast Asian societies. In some parts of Malaysia, Singapore and Thailand, the culture of worship-ping termite mounds is practiced, especially by local Chinese communities. Mound-building termites, especially species such as *Macrotermes spp.* and *Globitermes spp.*, are widespread across the Malay Archipelago. Their earthen mounds may reach as high as 1.5m in height and 2m in diameter. Once a termite colony dies or becomes inactive, the termite mound can erode over time. In Malaysia, some local people see these inactive termite mounds as structures created by spirits. They believe that a local guardian resides in them, known as 'Keramat' in Malay and 'Datok Kong'(拿督公) in the Hokkien dialect. In fact, in Malaysia, Keramat-worshipping originated from Islamic mysticism and had been practiced in rural areas as far back as the pre-colonial period (1500-1870s). This was soon adopted by Chinese immigrants who believed that local guardian spirits found in nature should be paid respect in order to ensure their overseas security and prosperity.[6]

Even with urbanization, these species and their earthen mounds can be found relatively easily in residential areas, parks, and along roadsides. Residents in the neighborhood usually shelter inactive termite mounds within small red-painted shrines. Worshippers pray to the 'Datok Kong' for protection, good health, good luck, and on occasion to strike it lucky with the lottery.[7]

Notorious pest status in urban and agro-landscapes

Irrespective of their revered holy status, termites are regarded as a perennial unwelcome pest in both human settlements and farmlands. The annual damage caused by termites in 2005 was estimated to be US$50 billion worldwide, and in Southeast Asia alone, it was estimated to cost approximately US$400 million per year.[8] Unlike in temperate countries, it is common in Southeast Asia to find several termite pest species co-existing and infesting the same buildings, and worse, other termite species can re-infest building structures after previous termite treatments have been successfully carried out. Consequently, intensive and multiple treatments are con-sidered to be the only solution. This poses an uphill challenge to pest control personnel in Southeast Asia. Among oriental termites, the Asian subterranean termite, *Coptotermes gestroi* (Wasmann), is the most economically important and invasive species in Southeast Asia. This species is well adapted to

5.

Fig. 5:
An inactive termite mound is seen as a spiritual-made structure and it is believed that the structure is home to a 'local guardian', a 'Keramat' or 'Datok Kong'.

those environments where human settlements prevail and it attacks mainly wooden structures like cabinets, parquet floors, windows, door frames and roofs. In peninsular Malaysia and Thailand, approximately 85-90% of termite infestations in urban areas are reportedly attributed to this one species alone.[9] Although they are believed to have originated from the Indo-Malayan region, they have spread, mainly through human activities, to the Marquesas Islands, Mauritius and Reunion (Indian Ocean), the New World tropics (Brazil and Barbados), some islands of the West Indies, Southern Mexico, the Southeastern U.S., Taiwan and more recently Sicily, Italy.

Termites are infamous for the damage they do to field crops, such as oil palm, rubber, sugar cane and the coffee tree in Southeast Asia. They attack plants by cutting and destroying the whole root system or hollowing into the root and causing inner damage to the plants. In particular, stressed plants, such as those under disease attack (i.e., fungal attack, microbial infection), insufficient watering or drought, and physical damage (e.g., fire, improper tree branch trimming) are generally the most susceptible to termite attack. We should keep in mind the impact of these small but powerful insects. In Vietnam, other mound-building termites are responsible for *more than* 90% of the collapses of river dykes and reservoir dams.

Public perception

We can see that in Southeast Asia, termites are an everyday part of people's lives in terms of nutrition, ritual practices, and their valuable ecosystem services to the natural environment. However, their pest status *outweighs any other perceived advantage.* Local farmers always view termites as a pest despite their ecological services to farmlands. Employing this soil-dwelling insect as part of a nutrient management strategies is rarely an option because these lack time efficiency and can pose unexpected risks if mishandled. Misconceptions have led to a great neglect of the valuable natural ecosystem services they provide to Southeast Asia's agro-landscape. In fact, there is evidence that indicates the termite attained its pest status from the time of the Asia's Green Revolution in the 1960s.[10] The revolution introduced technologies including agro-chemical fertilizers, pesticides and mono-culturing, which led to a significant distortion in biodiversity balance and ecosystem stability. These practices harmed termites' natural predators after pesticide application, and mono-culturing reduced alternative food sources for them. This created conditions whereby termite populations were forced to attack the only available mono-crops prepared for human consumption.

Yet, promisingly we are starting to see a shift in attitudes as agricultural producing countries start to promote sustainability in their agro-landscapes. Earthworms (soil-dwelling arthropods) are being reappraised for their highly valuable ecosystem services. However, unlike termites, the distribution of earthworms is limited and always absent from areas that are highly acidic and disturbed. We have learnt invaluable lessons from termites' ecosystem services in agro-ecosystems, but these were mainly from arid and afro-tropical regions in other parts of the world. What is now necessary is to look at how knowledge is applicable in a Southeast Asian context, which has a greater diversity of insect communities, complex agro-ecosystem processes and a specific socioeconomic background particular to the region. Only through social research inquiry combined with scientific approaches from biology and ecology on how to harness termites' services, can we reengage with the important and vibrant world teeming under our feet. To do so can potentially improve farmers' socioeconomic needs through promoting practical and practicable models of coexistence between termites and human society. And this will undoubtedly help us rehabilitate and reappraise the role of insects in future models of sustainable economic development in the region.

Kok-Boon Neoh is a Research fellow at the Center for Southeast Asian Studies, Kyoto University (neohkb@cseas.kyoto-u.ac.jp)

Notes

1 As evidenced by the oldest described fossil termite, *Meiatermes bertrani (f. Hodotermitidae)* found in Spain, which dates back to the Cretaceous period 130 million years ago.
2 However, the distribution of some termite species has extended to cooler zones and the global warming is seen to be one of the triggers behind this.
3 Eusocial means they have a high level of social organization.
4 Evans, T., et al. 2011. 'Ants and Termites Increase Crop Yield in a Dry Climate', *Nature Communications* 2, Article number: 262, doi:10.1038/ncomms1257
5 Mainly between the months of September and January.
6 Cheu, H.T. 1997. *Malay Keramat, Chinese Worshippers: the Sinicization of Malay Keramats in Malaysia.* Department of Malay Studies, National University of Singapore.
7 In contrast, we can also find inactive termite mound worshipping widely practiced in India, but only if a divine snake, the cobra, is found to be living in the mound.
8 Lee, C.Y. 2007. *Perspective in urban insect pest management in Malaysia.* Vector Control Research Unit, Universiti Sains Malaysia. 104 pp.
9 Lee, C.Y., Vongkaluang, C., & M. Lenz. 2007. 'Challenges to Subterranean Termite Management of Multi-genera Faunas in Southeast Asia and Australia', *Sociobiology* 50: 213-221.
10 See Black, H.I.J. & M.J.N. Okwakol. 1997. 'Agricultural Intensification, Soil Biodiversity and Agroecosystem Function in the Tropics: The Role of Termites', *Applied Soil Ecology* 6:37-53; Subhash Chander, et al. 2003. 'Changes in Pest Profiles in Rice-wheat Cropping System in Indo-gangetic Plains', *Annals of Plant Protection Sciences* 11:258-263