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SOME OBSERVATIONS ON THE MATING FLIGHTS OF THAI TERMITES

William H. Schaedla[1]

ABSTRACT

Using a fabricated light trap, I sampled the early rainy season mating flights of insects in a monsoonal mixed dipterocarp/teak/bamboo forest in Western Thailand. Three species of termites and two of ants flew on concurrent evenings, yet not simultaneously within those evenings. Two of the termite species, a *Microtermes* and a *Macrotermes*, exhibited well-defined flight times with little overlap. These genera were found living commensally in another study of Thai termites, lending credence to the theory that they may somehow influence each other's flight timing. Additionally, temporal partitioning of the flight environment could be influenced by external selection pressures such as predation and overall number of evenings acceptable for flight.

INTRODUCTION

Tropical Termites

Termites are important constituents of tropical and subtropical ecosystems. They consume a wide variety of dead plant materials: litter, leaf-fall, grasses, and wood. In humid African savanna they have been found to tailor their proportional consumption of these materials based on seasonal availability. Additionally, different species of termites living in the same habitat consume different materials in proportionally different amounts (LEPAGE ET AL. 1993).

Termites comprise as much as 50 percent of the total soil biomass in central Amazonian rain forest (BANDEIRA & TORRES, 1985). Diversity of termites in terre firma and swamp sites of Brazilian rain forest is also high; 64 and 11 species respectively have been found in these two habitat types (CONSTANTINIO, 1992).

Drier scrub (cerrado) forests of Brazil are similarly diverse in termites. At least 17 different species were found nesting comensally in the mounds of one keystone species, *Cornitermes cumulans* (REDFORD, 1984). Such cohabitation of nests may have a defensive advantage in the face of predation, different species possessing different mechanisms for warding off attack (COLES, 1980).

While some 90 species have been recorded from Thailand (AHMAD, 1965), comparatively little ecological research has been done on the termites of Thai forests. They are abundant, and interactions between different species presumably occur, but there is a scarcity of data on the subject.

[1] P.O. Box 659 Corrales, NM. 87048 U.S.A. email: whschae@rt66.com
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In one recent study (ABE & INOUE, 1993) of the peat swamps and rubber plantations of Narathiwat, Thailand, termite nests were found to occupy a wide variety of microhabitats within the same forest, including: standing trees, both dead and alive; the basal parts of living trees; fallen trees and logs on the forest floor; and subterranean chambers or mounds constructed by the termites themselves. Where termite constructed mounds did occur, they tended to be evenly spaced in order to accommodate associated subterranean galleries. These mounds and their associated galleries were found to house colonies of three separate species of termites living commensally.

Macrotermes gilvus were the mounds' architects. Other inhabitants were an *Odontotermes* species and a *Microtermes* species (ABE & INOUE, 1993). Representatives of all three genera are common throughout the whole of Southeast Asia (ROONWAL, 1970).

Nuptial Flights

A characteristic common to all colonially nesting species of termites is nuptial or mating flights. Male and female reproductives (alates) disperse, copulate, and form new colonies. Cues for flight may be related to any of a number of meteorological conditions. Ambient light, temperature, moisture conditions, barometric pressure, and electric properties of the atmosphere can all have a bearing on their synchronization (NUTTING, 1969). Conspecifics from different termite nests are assumed to synchronize their flight times via use of the same cues. Such concurrent flights have been noted repeatedly in the literature (HARRIS & SANDS, 1965, NUTTING, 1966, WEESNER, 1965). Different species found in the same area may use different cues (NUTTING, 1969).

In seasonal environments such as tropical monsoon forests (*i.e.*, most of Thailand), these nuptial flights are restricted to certain times of the year, namely, periods when there is moisture. All termite species are soft-bodied and vulnerable to desiccation. Additionally, many nest building termites make extensive use of soil as a building material. Construction activities are easier when the ground is soft from precipitation. In order to maximize the period during which they can build, most termite species fly at the onset of the rainy season. Early evenings at this time of year find the air literally clouded with reproductives.

The aim of this study was to discern whether differences occur in the timing of different species' flights.

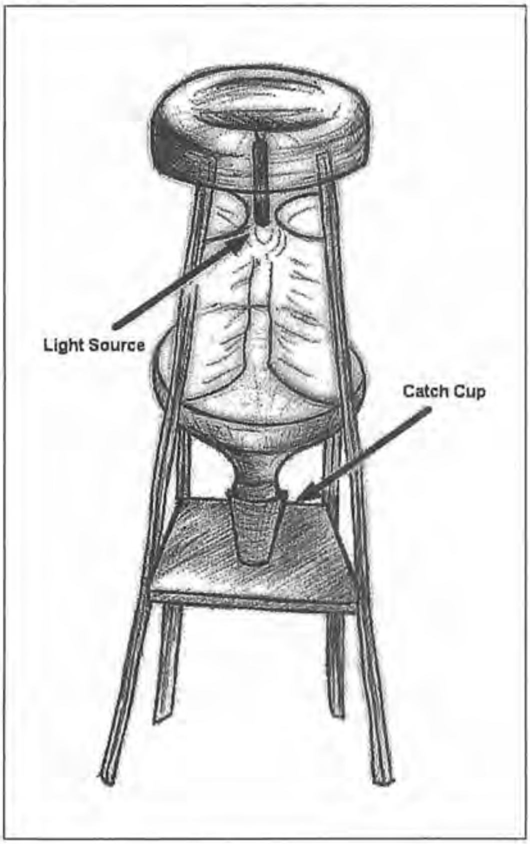
MATERIALS AND METHODS

Following a standard design (UPTON & NORRIS, 1980), I fashioned a makeshift light trap for collecting insects from a clear plastic water cooler bottle (Figure 1.). I removed the top and bottom and inverted the sides. Turned upside-down and suspended from a bamboo frame, the bottle functioned as a funnel for directing flying insects into a cup filled with formaldehyde solution. A Mini Mag-Lite™[1] hand torch provided light which attracted the insects.

[1] Use of this brand name in no way implies endorsement of the product.

A. Uncut Clear Plastic Water Bottle

B. Bottle Cut for Trap Construction



C. Completed Trap Showing Light Source and Catch Cup for Insect Specimens

Figure 1. Light Trap Construction.

Trapping took place at a single site in Sai Yok National Park in Kanchanaburi Province, Thailand. The area is characterized by mixed deciduous dipterocarp, bamboo, and teak *(Tectona grandis)* growth. It is located approximately one kilometer from the Kwae Noi River, near the park's headquarters/housing area. It is subject to pronounced seasonal variation in precipitation, and trapping took place during the beginning of the 1993 rainy season (late May–early June).

I conducted trapping sessions on evenings when termite reproductives were active. These sessions lasted from the onset of mating fight activity (dusk, at approximately 1915h) until their alates stopped flying (no later than 2045h). I examined the trap at 15 minute intervals, and transferred its entire contents to specimen jars for later examination.

Because the object of the study was a comparative examination of data, I considered comprehensiveness of trapping period important. On evenings when sampling was cut short by the onset of rain, I terminated trapping. Sporadic rain during a session was also basis for aborting trapping and nullification of an evening's data.

Members of the Wood Pathogens Division of the Thai Royal Forest Department assisted in termite identification. Identification was to genus only; more specific classification was not possible due to the lack of representatives of castes other than reproductives.

RESULTS

Three complete evenings of trapping were possible. Table 1 shows the numbers and species of insects trapped on each occasion. The alates of three species of termites (a *Microtermes*, a *Macrotermes*, and an *Odontotermes*) and two of ants (unidentified) flew into the trap. Termites were of the same genera, if not the same species, as those found living comensally in Narathiwat (ABE & INOUE 1993).

Microtermes and *Macrotermes* were, by far, the most abundant of all the insects in the traps. Figure 2 is a graph of their average numbers over time. Mating flights were well defined chronologically, lasting approximately an hour per species. There was little overlap between *Microtermes'* and *Macrotermes'* nuptial flights. For both species, numbers of termites peaked roughly 30 minutes after flight began. The peaks for each occurred approximately 30 minutes apart. During the half an hour of overlap between the two species, few individuals of either species flew. By contrast, the density of termites was exceedingly high at peak times, always above 400 individuals during a single 15 minute trapping period.

The numbers of ant and *Odontotermes* reproductives caught in the trap were low by comparison to *Microtermes* and *Macrotermes.* Ants and *Odontotermes* also tended to show up in the trap later, without clear peaks to their flights.

Predation on the alates of all species was high. Reproductives in flight were eaten by bats, while those that landed were carried off by ants, carabid beetles, anurans, and geckoes.

Table 1. Numbers of insects captured over time.

Time	*Mictotermes*	*Macrotermes*	Ant species 1	*Odontotermes*	Ant species 2
			28 May 1993:		
19:15	271	6	0	0	0
19:30	510	1	0	0	0
19:45	15	85	10	1	0
20:00	11	512	18	0	0
20:15	7	43	53	0	0
20:30	2	7	30	0	7
20:45	0	0	1	0	0
			31 May 1993:		
19:15	252	2	0	0	0
19:30	519	5	0	0	0
19:45	11	10	7	1	0
20:00	4	497	15	0	0
20:15	7	31	60	0	1
20:30	1	0	21	0	9
20:45	0	0	1	0	1
			12 June 1993:		
19:15	199	2	0	0	0
19:30	483	12	1	0	0
19:45	21	107	7	0	0
20:00	6	529	7	0	0
20:15	2	59	43	0	1
20:30	0	10	38	0	9
20:45	0	0	0	0	0

DISCUSSION

It would appear that at least some of the insects involved in this study are avoiding overlap in their nuptial flights. Little about the mechanisms and reasons for this is clear. Three nights of trapping do, however, indicate that termite reproductives are somehow partitioning their environment temporally. *Microtermes* and *Macrotermes* mating flights are functionally concurrent, yet not simultaneous. They fly on the same nights, but without an absolute overlap in timing of their flights. This raises some interesting questions concerning interactions between the two species.

Flying at the beginning of the rainy season presumably gives an assurance of conditions being appropriate to the construction of new nests; but to what purpose are *Microtermes* and *Macrotermes* close in their flights during an evening? The relatively brief timing of

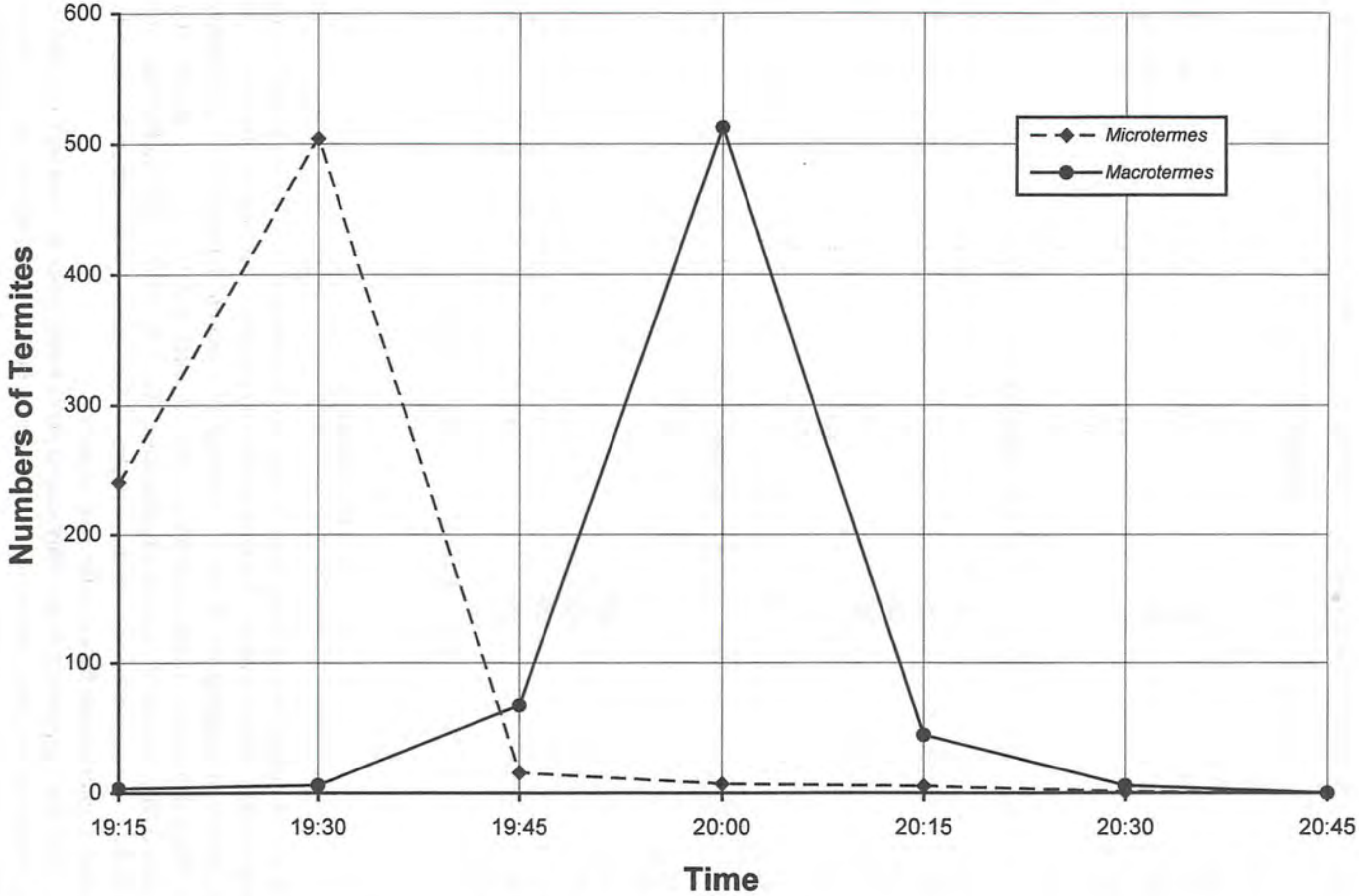


Figure 2. Average Numbers of Termites (*Microtermes* and *Macrotermes*) Caught Over time

termite nuptial events probably has some predator avoidance potential (NUTTING, 1969). Short sharply defined mating flights limit the amount of time alates are vulnerable. Clouding may also have some potential predator avoidance value, though for different reasons. A large number of insects in the air reduce any individual's chances of being eaten. Two species flying at almost the same time may enhance this value, yet be costly in terms of flight time delineation. Such a case would increase the duration and decrease the definition of the flights. However, the overall number of insects involved would be higher.

Flying at precisely the same time may be disadvantageous because of interference between species. If the ratio of one species to another is skewed, members of the lesser occurring species would suffer reduced chances of meeting conspecifics in flight. Interspecific interference would also occur if different species are using the same points of egress from a jointly inhabited mound. African *Microtermes havalindi* alates have been observed to emerge so thickly from their exit holes that they actually formed columns of termite bodies (FULLER, 1915). *Microtermes* flew before *Macrotermes* and *Odontotermes* at Sai Yok. It could be that in the process of exiting mounds *Microtermes* alates somehow prevent those of the other species from doing likewise.

Odontotermes badius builds special structures to facilitate mating flights (HARRIS 1961), and *Odontotermes assmuthi* builds special waiting chambers (SEN-SARMA, 1962). Activities of this sort could keep Sai Yok's *Odontotermes* species from interacting with *Microtermes* and *Macrotermes* if the three actually are living together comensally.

Additionally, *Microtermes* and *Odontotermes* may be dependent upon *Macrotermes* from the onset. As a commensals, they may be unable to establish nests on their own. Though if this is the case it raises questions about the ordering of flights. *Odontotermes* flew after *Macrotermes* and could thus be an immediate dependent, but *Microtermes* flew before either of the other species.

It remains to be discovered what initiates mating flights in Sai Yok's termites. Obviously weather conditions play a role, but it is also possible that some of the insects involved are relying on other species for cues. More specific identification and research on Sai Yok's termites would be useful, and an assessment of nests and identification of their inhabitants is necessary. Without such, no firm conclusions about species interactions are possible.

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