# TERMITE SWARMING AND LOCAL WEATHER PATTERNS: A PROGRESS REPORT

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Our main purpose is to discover whether or not any causal relationships exist between climatic conditions and the swarming and colony founding behavior of termites. In warm temperate and tropical zones termites are important detritivores that contribute a significant portion of their annual production in the form of winged reproductives or alates (Nutting & Haverty 1976). They leave the parent colonies for short dispersal flights, settle on the ground or wood where the sexes pair off, lose their wings and, together, dig into the substrate as kings and queens of new colonies. These swarms, or flights, are essentially seasonal and frequently associated with rainfall or high moisture conditions. In regions with cold winters and evenly distributed rainfall, swarming is limited to warmer summer months. In the tropics this phenomenon is generally associated with a single rainy season. In regions where there are two rainy seasons termites may fly during each of them (Nutting, 1969). Such is the case in the semi-arid areas of the southwestern United States and northwestern Mexico (Table 1).

In the southern Arizona fauna of 17 species, three subterranean species fly during the winter and spring, two of these obviously following the frontal storms of the winter rainy season. Although there are only a few of these storms each year, they may last for three or four days and leave several cm of rain. The flights of the other 13 that are known, four dry-wood, two damp-wood, and eight subterranean, are associated to varying degrees with the convectional storms of the summer rainy season. These are usually more numerous than the winter storms, typically brief but violent, and they may leave anything from a layer of dust to several cm of rain.

The flights serve for the dispersal and the bringing together of the sexes, presumably from different colonies, for the purpose of founding new colonies. It is critical that they be synchronized between colonies of the same species over wide areas. It seems probable then that the flights must be scheduled in response to some common signal in the environment such as a change in temperature, atmospheric pressure or light intensity. However, it would not be surprising to find that certain temperature and moisture (in one phase or another) conditions are prerequisite for the operation of these cues. The factors which delimit the flight season are probably near-threshold values of those which control the daily flight periods.

Table 1. Flight schedule of Arizona termites.

| | |
|---|---|
| **Winter/Spring** | |
| Subterranean | |
| *Reticulitermes tibialis* | day ; < 1200 m |
| *Amitermes coachellae* | day ; day after rain |
| *Amitermes emersoni* | day ; day after rain |
| **Summer** | |
| Dry-wood | |
| *Pterotermes occidentis* | night |
| *Incisitermes banksi* | evening |
| *Incisitermes minor* | day |
| *Marginitermes hubbardi* | evening ; 0-3 days after rain |
| Damp-wood | |
| *Paraneotermes simplicicornis* | evening |
| *Zootermopsis laticeps* | night |
| Subterranean | |
| *Reticulitermes tibialis* | day ; >1200 m |
| *Heterotermes aureus* | evening |
| *Amitermes minimus* | morning ; day after rain |
| *Amitermes pallidus* | evening |
| *Amitermes silvestrianus* | pre-sunrise ; day after rain |
| *Amitermes wheeleri* | pre-sunrise ; day after rain |
| *Gnathamitermes perplexus* | day, evening ; in rain or not |
| *Tenuirostritermes tenuirostris* | night ; during rain |

## Materials and methods

As the basis of our study, nearly continuous records of the flights of 14 species have been kept at one urban location in Tucson since 1961. In addition to behavioral notes, the records include date, time and number of alates per flight, air temperature, rainfall, relative humidity and evaporation, time of sunrise and sunset, and atmospheric pressure (since 1971). The data are punched on IBM cards for computer processing and preparing yearly flight data summaries and meteorological data summaries (for flight and non-flight days during the season). Various parameters from the flight and meteorological summaries are being analyzed to identify any possible cues which trigger the flight of each species. Notes on the flight behavior of each species are being compared ecologically as well as phylogenetically, and will provide a basis for experimental work on alate behavior.

## Results and discussion

Table 1 summarizes current knowledge on the flight schedules of Arizona termites and suggests possible flight-triggering conditions which we have proposed largely on an intuitive basis. For example, five species of Amitermes fly at particular times of day following rainfall of a few mm or more on the previous day. The flights of most of the subterranean species are apparently associated with rainfall to varying degrees and, presumably, the accompanying increase in soil moisture and relative humidity. Data on Marginitermes hubbardi suggest that moisture may have some less obvious influence on the flight of dry-wood termites.

Reduction of data from Tucson is providing flight summaries for each species as illustrated by that being developed for Heterotermes (12 yrs of data): Seasonal limits Jun 8 - Oct 4, mean Jul 11 - Sep 1; season 9-100 days, mean 51.6±27.1; largest flight between Jul 8 - Aug 13, mean Jul 26 ± 10.7 da; 3-16 flights/season, avg. 9.4± 4.3; avg. no. alates/flight (@ house lights) 31.7 (8-102) or 298.3 ± 231.9 (35-599)/season. Flights generally follow rain within 1-3 da. They begin ca. 10 min. after sunset and may continue for ca. 1 hr. Phenological analyses involving heat sums between estimated beginning of alate development and peak flight date have not produced very realistic results. We are continuing to develop long-term flight summaries for each species and to determine whatever relationships may exist between major meteorological variables, the flight season, and daily flight periods.

## References

Nutting, W.L. 1969. Flight and colony foundation. In: K. Krishna & F.M. Weesner (Ed.): Biology of termites, v.1. Academic Press, New York. p. 233-282.

Nutting, W.L. & M.I. Haverty, 1976. Seasonal production of alates by five species of termites in an Arizona desert grassland. Sociobiology 2:145-153.