Daily and Seasonal Periodicities in the Nuptial Flights of Neotropical Ants. I. Dorylinae.

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In 1967 I spent the months of February through May in Central America studying various aspects of ant behavior and ecology. Included in these studies were observations of nuptial flights and mating attraction. In order to ascertain which species had flights at this time of the year and to determine the mechanisms for initiation of flights, I collected the alate ants that appeared at lights which had been set up to attract insects from the adjacent forest.

This study was carried out at Barro Colorado Island, a field station of the Smithsonian Tropical Research Institute, located in Gatun Lake, Panama Canal Zone. Barro Colorado Island is an area of approximately 3,600 acres and, except for several small clearings, is densely covered by semi-evergreen, seasonal, tropical forest which has been undisturbed for nearly 50 years. This study was begun during the middle of the dry season and continued approximately one month into the wet season. From the first of March until the 21st of April (the onset of the wet season in 1967) a total of 2.51 cm of rain fell. This represents less than one-hundredth the mean annual rainfall.

The buildings constituting the laboratories and living quarters are located on the northeastern position of the island on a ridge about 200 feet above lake level. Six feet above the ground on the wall of the southeast side of the Dormitory Building, facing a densely forested ravine, is a light fixture containing two 40-watt fluorescent (black-light) tubes. Insects that were attracted to these lights flew onto the screen below the lights and crawled or flew up toward the lights. A second light was operated in the forest off Snyder-Molino Trail (marker 0.2).

The two lights were turned on about 1845 each evening. The dormitory light was observed continuously between approximately 1845 and 2000 and 0400 and 0600 from March 1 to May 31, 1967, except that no observations were made between the morning of April 24 and the evening of April 29. Occasional observations between 2000 and 0400 were made on several nights. With the exceptions of a few specimens which flew off before I could catch them, all specimens seen were collected. Collections were separated on a half-hour basis and preserved immediately in 85% alcohol.

The forest light was operated from February 26 to April 4. Collections were made at approximately 0615-0630 and usually represented only males which had arrived earlier in the morning.

Some of the largest and most conspicuous ants attracted to these lights were male army ants (Formicidae: Dorylinae). Army ant societies are unusual in that the reproductive females are permanently wingless, so that the winged males represent the only agency of cross-fertilization in each species. Males are produced in large numbers relative to the reproductive females and apparently always begin their nuptial flights at night. That army ant males are attracted to lights is well known. Indeed, some species are known only from the males which have been collected at lights (Borgmeier, 1955). However, it is only recently that a systematic study of male appearance at lights has been carried out. Haddow et al., (1966) described the nocturnal cycle of driver ant (Dorylus) males in East Africa.

The army ants on Barro Colorado Island have been studied for many years by Schnierla, and more recently by Rettenmeyer and Akre. In contrast to the extensive knowledge accumulated on colony behavior and brood development of several species of Eciton, very little is known of the male activities. Flights of Eciton spp. on Barro Colorado are discussed by Schnierla (1948). Borgmeier (1955) records males of nine species which were collected at lights on Barro Colorado. Males of six species collected at lights on the island are recorded by Rettenmeyer (1963).

Over the three month period a total of 1226 specimens representing fifteen species were collected and identified (Table I). Of these, the identification of one taxon is incomplete (Neivamyrmex species A), and two others (Nomamyrmex hartigi and Neivamyrmex guyanensis) are

Table I. Doryline Species Collected at Lights.

Species	Number of Specimens Collected	Per Cent of Total
Labidus coecus (Latreille)	27	2
Labidus praedator (F. Smith)	127	10
Eciton burchelli (Westwood)	5	0.5
Eciton hamatum (Fabricius)	16	1
Eciton jansoni (Forel)	1	Trace
Nomamyrmex esenbecki (Westwood)	165	13
Nomamyrmex hartigi (Westwood)	569	47
Neivamyrmex guyanensis (Santschi)	7	0.5
Neivamyrmex klugi (Shuckard)	9	1
Neivamyrmex pilosus (F. Smith)	180	15
Neivamyrmex pullus Borgmeier	7	0.5
Neivamyrmex scutellaris Borgmeier	6	0.5
Neivamyrmex spoliator (Forel)	33	3
Neivamyrmex swainsoni (Shuckard)	63	5
Neivamyrmex species A	11	1
TOTAL	1226	

new records for the island. The lack of a prior record of N. hartigi from Barro Colorado is surprising in view of the fact that nearly half of all army ant males collected were of this species.

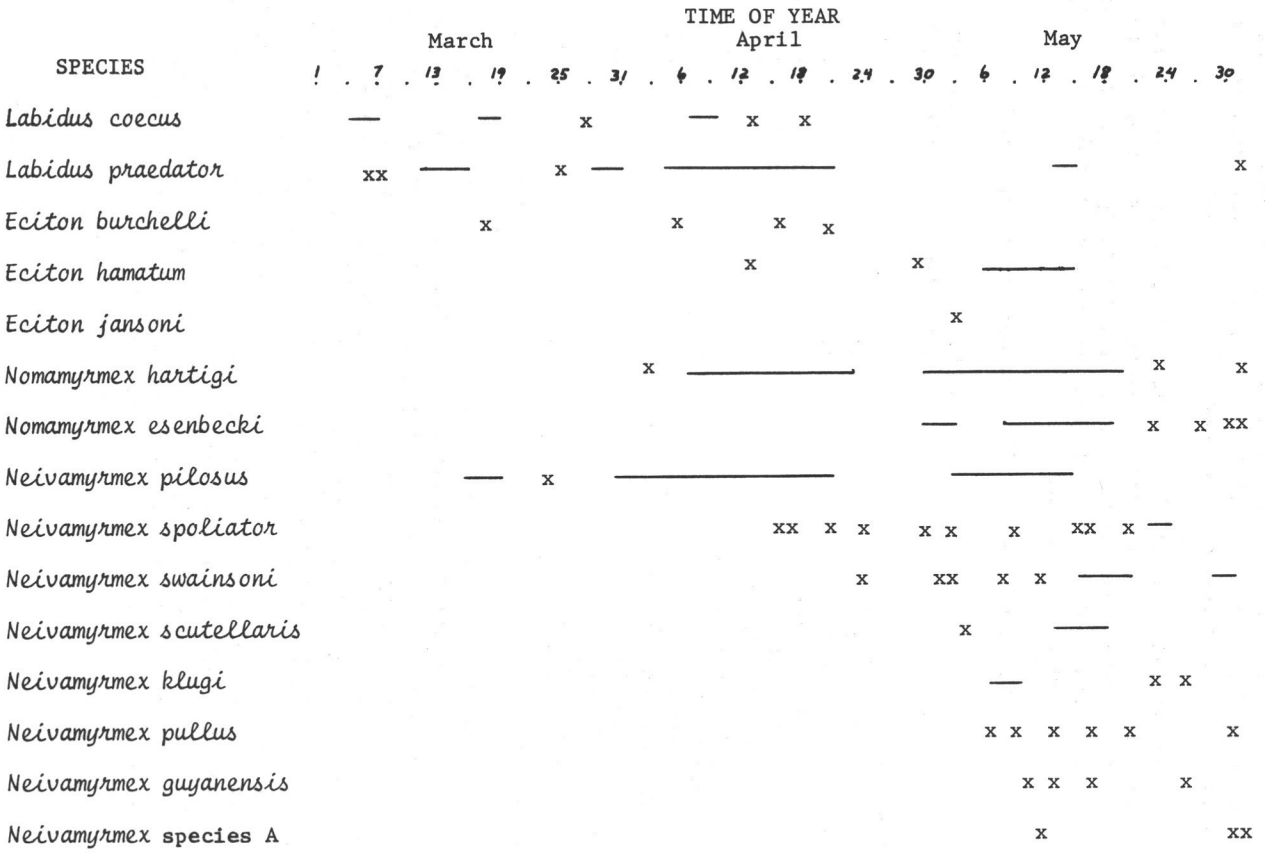
N. hartigi also had the highest rate of males per night collected (Table II). The largest number collected in one night was 74 during a one and one-half hour period on 17 May. On 11 April 59 males were collected between 0500 and 0530. On the other hand, males of Eciton spp. rarely appeared at lights.

Table II. Number of Males per Night Collected

Species	Number of Nights with Males	Number of Males per Night
Nomamyrmex hartigi	42	13.5
Nomamyrmex esenbecki	19	8.7
Neivamyrmex pilosus	35	5.3
Neivamyrmex swainsoni	12	5.2
Labidus praedator	31	4.1
Neivamyrmex species A	3	3.7
Neivamyrmex spoliator	13	2.5
Labidus coecus	12	2.3
Eciton hamatum	9	1.8
Neivamyrmex guyanensis	4	1.8
Neivamyrmex klugi	5	1.8
Eciton burchelli	4	1.2
Neivamyrmex pullus	6	1.2
Neivamyrmex scutellaris	5	1.2
Eciton jansoni	1	1.0

The seasonal appearance of males at lights is shown in Fig. 1. In this figure the solid lines represent periods of 3 or more nights of consecutive collections with perhaps an occasional break of a single night. Each "x" represents an isolated evening on which the species was collected. Males of two species (Labidus coecus and Eciton burchelli) were collected only during the dry season. Three other species (Labidus praedator, Nomamyrmex hartigi and Neivamyrmex pilosus) were found at lights from the dry season well into the wet season. The occurrence of L. praedator spanned virtually the entire period of this study, although not continuously. The remaining species were collected almost exclusively after the onset of the wet season. The correlation of flights with the onset of the rainy season suggests that the rains serve as a trigger mechanism. Such a mechanism would be especially useful to the hypogeic species (Neivamyrmex spp).

Figure 1. Seasonal occurrence of Doryline males at lights on Barro Colorado Island in 1967.



The frequency distribution of males during the hours of the night is shown in Fig. 2. These species appear to form two distinct groups: the post-sunset flights (Eciton spp., Neivamyrmex spoliator, N. pullus, and N. species A) and the pre-dawn flights (Labidus spp., Nomamyrmex spp., Neivamyrmex swainsoni, N. klugi, N. scutellaris and N. guyanensis). Neivamyrmex pilosus, although most frequent in the pre-dawn hours, may be found between 2130 and 0600 and is the most nearly circum-nocturnal species on the island.

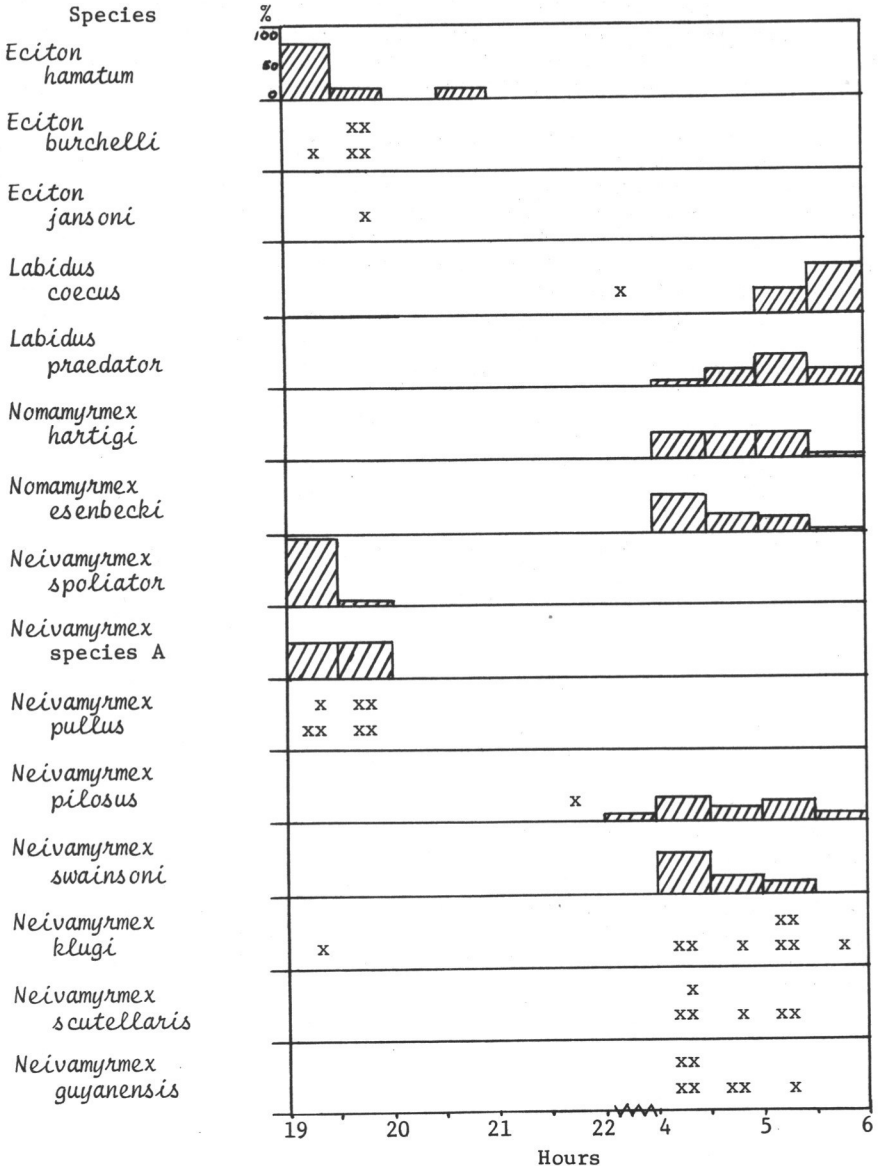
While this study was in progress, three periods of bright moonlight occurred: March 26 - April 1; April 23 - 29; and May 21 - 27. Two species (Nomomyrmex hartigi and Neivamyrmex pilosus) occurred in sufficient abundance continuously through dark and light periods to show the effect of moonlight on these insects (Table III). Clearly, the presence of bright moonlight results in a marked reduction in numbers attracted to the artificial light. Whether the males do not fly in such large numbers on bright nights or whether they are attracted elsewhere because of the moonlight is not known. The latter seems to be a more reasonable hypothesis to me.

Table III. Comparison of Male Collections on Bright and Dark Nights

Nomamyrmex hartigi				Neivamyrmex pilosus			
Bright		Dark		Bright		Dark	
April 23	6	April 11	59	March 25	0	April 6	3
April 24	1	April 12	58	March 26	0	April 7	20
April 30	7	April 13	25	March 27	0	April 8	8
				March 28	0	April 9	3
				March 29	0	April 10	2
				March 30	1	April 11	0
				April 23	0	April 12	4
				April 24	0	May 4	18
				April 30	0	May 5	8

The interface between the dry and wet seasons appears to be the most important time of the year for army ant nuptial flight activity in the region of Barro Colorado Island. However, an intensive study of alate activity during the period from June through February is needed to provide a full understanding of the seasonal periodicities of these army ants. Also needed are comparable studies in other neotropical areas.

Figure 2. Time of Doryline male appearance at lights, Barro Colorado Island, 1967.
(In per cent of males of each species collected. x = one male)



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