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FLIGHTS OF THE ANT *POLYERGUS LUCIDUS* MAYR*

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Flights of ants at the Edwin S. George Reserve, Livingston County, Michigan, have been studied over a number of years (Talbot 1956, 1959, 1963, 1964, 1966, and Kanno 1959a, 1959b). This paper is another in the flight series and concerns the slave-making ant, *Polyergus lucidus* Mayr.

Polyergus colonies are scattered over the George Reserve, living in open fields or at woods' edge and forming mixed colonies with *Formica pallidefulva nitidiventris* Emery. The flights recorded here took place mainly from the Lawn Colony, where 26 flights were seen during 1960, 1961, and 1962. These observations were supplemented, for comparison, by records of seven flights from two other colonies.

The main flights of *Polyergus* at the Reserve took place during August. They began in late July and extended into early or mid-September. July 31, 1962 was the date of the earliest flight seen, although a dealate female was found on July 28, 1964. The latest flight recorded, on September 9, 1963, liberated only three males. The flight season at any one colony is long, probably a month to six weeks, and the time of starting and stopping flights must vary considerably from colony to colony, depending on local environment of the nest and rate of maturing of the brood.

Polyergus spread the maturing of brood of winged ants over an extended period, and flights began long before all of the adults had emerged. Winged pupae have been found as early in the year as June 19, 1962, and as late as September 1, 1964. The earliest time that adult winged ants were found was July 21, 1962, and there were still some in the nest on September 9, 1963, when the latest observations were made.

The total number of males and females produced could not be determined because not all of the flights of a year were seen. One medium-sized colony that was dug and counted still had 115 females, 407 males, and 13 male pupae on September 1, 1965. Eight flights of

*The work was assisted by a grant from the United States National Science Foundation. Facilities of the University of Michigan's Edwin S. George Reserve were made available by Dr. Francis C. Evans, Associate Director, and Dr. T. H. Hubbel, Director of the Reserve.

Manuscript received by the editor November 27, 1967

the Lawn Colony, recorded in 1961, yielded a total of 58 females and 814 males. The largest flight seen at this nest, August 18, 1961, liberated 17 females and 335 males.

Polyergus flights were distinguished by several outstanding characteristics. They took place in early afternoon at very high temperatures. They required bright light and were delayed or prevented by any cloud that came over the nest. Gusts of wind stimulated flying. Males executed a kind of "dance" as they ran up and down grass blades and over and around each other before they seemed ready to fly.

Time of day. Flights took place in the early afternoon and did not vary greatly in time of day. At the Lawn Colony males might come out and begin climbing grasses as early as 12:31 PM (E.S.T.) or as late as 2:10 PM, but the usual time was about 1 PM. Flying might begin anywhere from three to 60 minutes later, the mean time for 21 flights being 1:16 PM. The two other colonies had a slightly later time pattern. At the Hidden Valley nest alates began flying at about 1:45 PM and the 0-26 Colony was even later, with 2:01 PM as its mean time.

Temperature. All flights took place at high temperatures. On one occasion males began to climb grasses at 77°F*, and the first flew at 78°F; but for all other flights the temperature was 80°F or more. Temperatures between 85°F and 90°F were especially favorable. Above 90°F ants climbed grasses quickly, and males were especially active in their "dance." The Hidden Valley Colony had two flights at 96°F and 97°F; but at these high temperatures females could not run about on the ground as they usually did, and even on grasses they moved rapidly and flew quickly. Flights were not triggered by any certain temperature, for favorable temperatures were sometimes reached several hours before flights began.

Light. Flights occurred when the sun was almost directly overhead; and direct, bright light seemed essential. Any light above 7,000 foot-candles was favorable, and the Hidden Valley ants flew in the brightest light recorded (10,000 ft-c). Sparse flying could take place at light as low as 4,000 ft-c, and a few ants flew in even dimmer light. Cutting down of light by flickering shade of moving tree branches was tolerated rather well, but the more solid shade of clouds was not tolerated. Moving clouds could prevent or interrupt a flight. Although temperatures stayed between 87°F and 82°F on August 16, 1962, there was no flight because frequent fluffy white

*Temperature recorded 10 inches above the ground.

clouds kept alternating the light from as high as 9,200 ft-c to as low as 3,400 ft-c. A few males kept coming up on grasses and going down again, but they never had time between clouds for the running about which precedes flying. On August 28, 1962, after 41 males had flown and ten males were up in an actively moving group, a cloud reduced light from 7,400 ft-c to 2,300 ft-c. They all stood still until it passed. Soon after, when another cloud brought light down to 2,200 ft-c, they walked down and into the entrance, only to come up again when the cloud passed and the light brightened to 4,200 ft-c.

Wind. *Polyergus* flights were not prevented by any wind recorded. Breezes up to four to six miles per hour seemed to encourage male activity. An eight to eleven mph wind might make them stop moving and hold on, but it also stimulated the take-off into flight. Once, a record number of approximately 60 males flew upward with a 10-mph gust.

Typical flight activity. During the flight season single males and females often started coming into sight down in the nest entrance at about the time that *F. p. nitidiventris* workers began foraging in the morning (8:30-9:30 on warm mornings). From then on, every few minutes one or two would approach the surface and then retreat abruptly. By midday a group of male heads could be seen down in the entrance; and later, as the sun shone into the entrance, they would begin coming to the surface. At first one or two males would climb quickly onto grasses and then retreat as quickly. Soon some would stay, and a little mass of males would accumulate on the grasses above the nest. These would all be involved in a great activity, running up and down grasses and bumping into and running over each other in what seemed like a frenzied dance. In a few minutes there might be 50 to 150 males taking part in the movement; then, one by one, individuals would flutter wings and fly. Usually flying was rather sparse, with one to 15 males flying a minute; but the mass on grasses never stopped their jerky running, so there was always an impression of great activity. Some males did not take off well on their first few tries but instead flew and dropped to neighboring grasses, causing the flying area to increase in size. As many flew, the group on grasses lessened, activity slowed, and one by one the last stragglers took off. On days when only a few males emerged and flew there could be no interacting group, but each male would still run up and down grasses for several minutes before flying.

Females acted quite differently. Although one or two might come out and then duck back at any time during the morning, they did

Table 1. *Polyergus lucidus* — Record of 13 flights in 1962 at the Edwin S. George Reserve, Pinckney, Michigan.

1962 Date	Alates climbing grasses		Beginning of flight		Height of flight		End of flight		Number of ants flying		Length of flight				
	Time* Temp.*	Light*	Time Temp.	Light	Time Temp.	Light	Time Temp.	Light	♂	♀					
8-8	12:54	93°	8200	1:03	91°	8200	1:21	87°	8300	1:47	85°	3400	52	—	44 min.
8-11	1:15	81	8200	2:00	80	6200	2:06	83	6200	2:41	85	7400	13	3	41 min.
8-15	1:10	77	9000	2:10	78	8800	2:14	81	8000	2:58	80	6000	3	2	48 min.
8-18	1:15	79	9100	1:44	78	5400	2:20	80	4800	2:57	82	8400	14	3	73 min.
8-19				1:00	86	7800	1:24	86	8700	2:12	84	4800	122	3	72 min.
8-21	12:50	87	8300	12:58	85	8400	1:17	88	8000	2:19	89	8200	139	4	81 min.
8-22	1:10	83	9600	1:31	84	9000	2:01	82	8400	2:11	83	6800	18	2	40 min.
8-23	1:12	88	8400	1:15	88	8400	1:36	86	7600	2:08	87	7600	37	—	53 min.
8-24	1:09	93	8000	1:15	92	7900	1:32	92	7600	1:35	93	6200	14	—	20 min.
8-28	12:55	81	7600	1:02	82	7800	1:14	90	6800	1:57	86	4000	61	—	55 min.
8-29	12:59	87	6000	1:04	89	7800	1:19	89	7800	1:55	87	5800	17	—	51 min.
8-30	1:02	89	8000	1:18	89	8200	1:39	86	4000	1:59	87	5600	18	—	41 min.
9-2	1:15	84	8800	1:38	82	3600	1:51	83	5600	2:11	80	5800	30	—	33 min.
Mean	1:05	85	8266	1:23	85	7577	1:41	86	7062	2:13	85	6077	41		50 min.

*Time — PM Eastern Central; Temperature — Fahrenheit, 10 inches above the ground; Light — Foot candles, straight up. Relative humidity never seemed critical. It ranged from 46% to 77%.

not begin to move away from the structure until male flight had been going on for from 5 to 20 minutes. The females came out singly, and there were never many in sight at one time (1-9). A female would emerge, walk or run on the ground near the nest area, and climb up and down grasses, sometimes standing for a long time on a grass tip. After several minutes of this, she would climb a grass stem, flutter her wings, and fly. Often the first take-off was not successful; she would drop to a neighboring grass, and the wandering would begin again. This more leisurely action on the part of females sometimes prolonged flights for as much as eight to 28 minutes after all males had flown. The Lawn Colony did not produce many females; 58 were counted in three flights in 1961 and 17 in six flights in 1962. On these nine flights the time of flying of the first female was delayed beyond that of the first male by 16 to 51 minutes, with a mean of 36 minutes. The delay on the part of the females could not be accounted for on the basis of changes in temperature or light since the mean starting temperature and light for males were 83.3°F and 7,478 ft-c while for females they were 83.5°F and 7,288 ft-c.

Workers played only a moderate role in flights. *Polyergus* workers did not react to the alates in any way and only occasionally did one come to the surface, to retreat again soon or to move out into the grasses. *F. p. nitidiventris* workers enlarged entrances at the beginning of the flight season and reopened them after rains. During good flying weather they foraged busily, paying no attention to the alates. But sometimes at the start of a flight a group of 10 to 20 workers would follow the first males up onto grasses and try to get them to turn back, or they would hunt for stragglers at the end of a flight. Occasionally, under adverse conditions, such as lessening light or very high ground temperatures, they would become active in the middle of a flight. Males were often carried down grasses into the nest. The larger females were sometimes carried, but more often they were simply nudged until they retreated.

Colony founding. Once a female has mated and discarded her wings, her next problem is to locate a *Formica pallidefulva nitidiventris* colony which she can invade. One method by which young, dealate females find such colonies was discovered while raids were being watched at the O-26 and the Lawn Nests. On 15 different days, during flight seasons, one or two dealate females were seen hanging about a *Polyergus* nest during the afternoon. The females circled in the grasses and frequently cut across the nest area. *Polyergus* workers, running about in preraid activity, were hostile and

would try to bite any female encountered. On two different occasions one such female was seen to follow a raiding party to a *F. p. nitidiventris* nest, keeping just outside the column of ants. The first female was lost from view as she circled around the mass of ants entering the raided nest. The second, which had hung around the column edge, being bitten every time she got into a group, followed the raiding party for 43 minutes to a colony 213 feet away. At the raided nest she succeeded in getting down into the entrance three times but was pulled out each time by emerging *Polyergus* workers. It is not known if she finally got into the nest, but she did not return with the raiding ants.

This seems to be an excellent method of finding a colony to invade. The raiding ants not only lead a female directly to a colony but present her with one which is demoralized, depleted of brood, and probably saturated with *Polyergus* odor.

One incipient *Polyergus* colony was found on the Reserve. It consisted of a queen with a few pupae living in a small *F. p. nitidiventris* colony.

Contrasts in flights of POLYERGUS LUCIDUS and APHAENOGASTER TREATAE. Different species of ants show great variation in their flights—in time of year, time of day, and reaction to temperature, light, and wind. A comparison of *Polyergus lucidus* with *Aphaenogaster treatae* Forel is especially interesting because both live in open fields, and both have flights near midday when normally their workers are not above ground.

Polyergus alates flew in early afternoon, at high temperatures (97°-78°F), in bright light (10,000-4,000 ft-c), while their workers raided later in the day (3:06-8:14 PM), at lower temperatures (91°-65°F) and less intense light (6,300-260 ft-c). *Aphaenogaster treatae* flights also occurred near midday and usually on bright days when temperatures were too high for workers to forage (above 88°F). The contrast came from the fact that *A. treatae* could actually not fly under these extreme conditions, but waited until a passing cloud modified them briefly. Thus, they had a flight on one day when temperature was 91°F and light 9,200 ft-c but they came out and flew only when a brief cloud reduced temperature to 85°F and light to 2,400 ft-c (Talbot 1966). Such a cloud would have stopped a *Polyergus* flight. The two species also reacted differently to wind. Winds as low as 2 mph caused *A. treatae* alates to retreat, while much higher winds stimulated *Polyergus* flying.

SUMMARY

At the Edwin S. George Reserve, in southern Michigan, flights of the ant *Polyergus lucidus* took place in late July, August, and early September. They occurred in the early afternoon when temperatures were high (97°-78°F) and light bright (10,000-3,600 ft-c). Passing clouds could prevent or delay flights, but winds did not. Males formed very actively moving clusters on grasses before flying. Females came out singly and usually walked away from the nest before climbing and flying. Some dealate females found *Formica pallidefulva nitidiventris* colonies to invade by following raiding parties of *Polyergus* workers.

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TALBOT, MARY

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