

Effect of Climatic Factors on the Swarming Ants in a Park of El-Harrach (Algeria)

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ABSTRACT

The present study was conducted in a suburban area in a park of El-Harrach at the Agronomical Upper National School of Algiers. The park enjoys a Mediterranean climate throughout the year, the temperatures are subject to the influence of the sea, the winter is cold and the summer is hot and dry. Sampling (sexed ants) took place in the park during the regular shot from April to December, during two years 2006 and 2007. The periods of swarm are evaluated according to few climate data, for the purpose of determining intervals in humidity and temperature corresponding to the dates of swarming winged ants. The intervals traced differ from one species to another by limits that are particularly close.

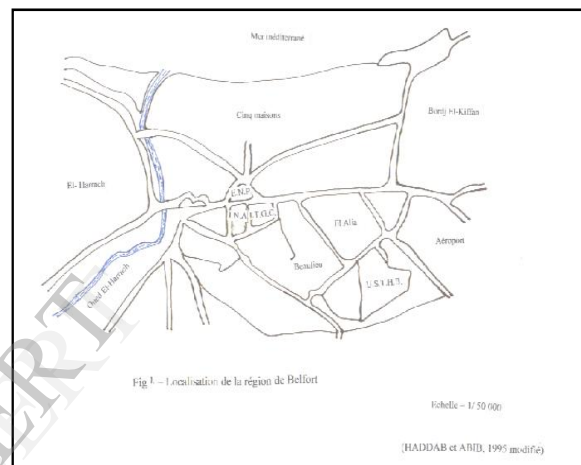
Key words: park of El Harrach,, Mediterranean climate, sexed ants, intervals.

1. Introduction

Outside ant communities, the spin-off has received little attention. Our interest in this study goes back to Fahrenheit Réaumur (1683_1757), the first among the modern who discovered the spin-off. In Algeria, it is useful to note a few attempts [1], [2] and [5]. The aim of this study is to complete our current understanding on the classification of Formicidae by collecting the three casts. The second main objective is to provide responses of temperatures and weather conditions on ants in making intervals.

2. Presentation of the area of Study

The plateau of Belfort is part of the eastern Mitidja's plain (Fig.1) on the geomorphological plan, the plain provides a fairly high degree of homogeneity. The little sophisticated soil and the soil to sesquioxide of iron are the soils most encountered in this region. Precipitation is variable with a mean of 607 mm/year in 2006 & 768 mm/year in 2007. Temperatures range between 10,1 and 25,2°C. in 2006 and between 12 to 25,1°C. in 2007. The operating site is a suburban environment of 12 ha including the experimental plots and the teaching buildings (3° 08' E, 36 ° 43' N) at 50 m. altitude. The park contains a collection of ornamental plants stepped on three strata, a stratum tree of 2 to 20m high, a shrubby stratum from 1 to 2m and a herbaceous stratum of 0,1 to 1m.



3. Material and methods

The experimental study consisted of catching winged ants by super net or simply by hand catching. The sexed ants have been captured during a period from April to December in the year 2006 and 2007. The laboratory's examination allows to identify the species and to separate the sexes. In order to highlight the effect of climatic factors, we have taken into consideration all the values of temperature and humidity recorded corresponding to the days of capture of winged ants daily registered in weather forecast.

4. Results

4.2. Inventory of sexed ants collecting at the park of El-Harrach in 2006 and 2007

10 species of ants were collected during 9 months of sampling (Table1 and 2).

Table 1. Results on the swarming observed in the park of El-Harrach in 2006.

Species	IV	V	VI	VII	VIII	IX	X	XI	XII
<i>Tapinoma nigerrimum</i>	1	1	1	0	0	0	0	0	0
<i>Aphaenogaster testaceo-pilosa</i>	0	1	1	1	1	1	1	0	0
<i>Cataglyphis bicolor</i>	0	1	1	1	0	0	0	0	0
<i>Tetramorium biskrensis</i>	0	0	1	0	0	0	0	0	0
<i>Pheidole pallidula</i>	0	0	0	1	0	0	0	0	0
<i>Camponotus</i> sp.ind.	0	0	0	0	0	0	0	0	1

1: presence

0: Absence

Table 2. Results on the swarming observed in the park of El-Harrach in 2007.

Species	IV	V	VI	VII	VIII	IX	X	XI	XII
<i>Tapinoma nigerrimum</i>	1	1	1	0	0	0	0	0	0
<i>Aphaenogaster testaceo-pilosa</i>	0	0	1	1	1	1	1	0	0
<i>Cataglyphis bicolor</i>	0	1	1	1	0	0	0	0	0
<i>Tetramorium biskrensis</i>	0	1	1	1	1	0	0	0	0
<i>Pheidole pallidula</i>	0	0	0	1	0	0	0	0	0
<i>Messor barbara</i>	0	0	0	0	0	1	1	1	0
<i>Camponotus barbaricus xantomelas</i>	0	1	1	1	1	0	0	0	0
<i>Ponerinae</i> sp.ind.	0	0	0	1	0	0	0	0	0
<i>Crematogaster</i> sp.ind.	0	0	0	0	1	0	0	0	0

According to the results above in table 1 and 2, most of the ants swarm between the months of May and October except for few species. Usually, the factors involved are purely climatic. According to these observations, it is estimated that the duration of swarming depends mainly on the temperature, and humidity. Other factors remain secondary.

4.2. Impact of a climatic factors on the swarming ants

A daily monitoring has been done at the level of the weather station of the school. The average temperature and humidity with the rainfall recorded in the days of Spain are noted in table 3.

Table 3. Climate data recorded in the days of catch of winged ants in the park of El Harrach.

Table 3

The table shows the variation of temperature and humidity during the days of spin in the species *Tapinoma nigerrimum*

(Nyl. 1886), *Aphaenogaster testaceo-pilosa* (Lucas, 1846), *Cataglyphis bicolor* (Fabricius, 1973) and *Messor barbara* (L. 1767). The emergence of the first spin-off was made in the month of April, it affects the species *Tapinoma nigerrimum* to an average temperature of 18,9 °C. We note the spin-off of *Messor barbara* in an average temperature of 18,5 °C, as a result of a precipitation of 9,4 mm recorded the same day in the month of October. The daily average temperature the most high is recorded in August, it is of 27,5 °C. where we observed the flights of *Aphaenogaster testaceo-pilosa* with a value of humidity average of 67,5 %. Between 20 °C and 24 °C are noted the swarming of *Cataglyphis bicolor*. The value of high humidity recorded for this species is of 95,5 %.

4.3. Factorial Analysis applied on winged Ants captured in the area of study in 2006 and 2007

The species taken into consideration are the sexed ants during the nuptial flights in which the two areas of study during the year 2006 and 2007. the analysis of factorial correspondence is used for highlighting a seasonal variability among the sexed ants. The analysis takes account of the presence or absence of species depending on the months of research. The winged ants captured in function of the month are designated in tables 1 and 2 above.

4.3.1. Factorial Analysis in function of months in 2006 The contribution of the species of ants during the different months in 2006 to the total inertia is equal to 48,3 % for the axis 1 and 23,8 % for axis 2. The sum of these two rates is equal to 72,1 %. Because of this, a large information may be given through the plans determined by the pins 1 and 2 (Fig.2).

* The participation of the month for the training of axis 1 and 2 is the following:

Axis 1: The month of June (VI) with 28,6 % and those of May (V) and July (VII) with 21,4 per cent are involved the more in the construction of the axis 1.

Axis 2: The month of April (IV) with 37,6 % and that of July (VII) with 23,02 % who participate the more in the development of axis 2.

* The participation of the species of ants to the training of pins 1 and 2 is the following:

Axis 1: The species of *Aphaenogaster testaceo-pilosa* which occurs the most in the formation of the axis 1 with a rate equal to 42,9 %. It is followed by those of *Tapinoma nigerrimum* and *Cataglyphis bicolor* with 21,4 % for each. The other species are with lower rates.

Axis 2: *Tapinoma nigerrimum* is the species that contributes the most in the development of axis 2. It participates with 55,5 %. *Aphaenogaster testaceo-pilosa* is the species that occurs in the second position with a percentage equal to 22,6 %. Other species occur with lower rates.

* Distribution of the months following the quadrants:

The months of April, May and June are located in the quadrant I, those of July, August, September, October and November are confined in the quadrant IV.

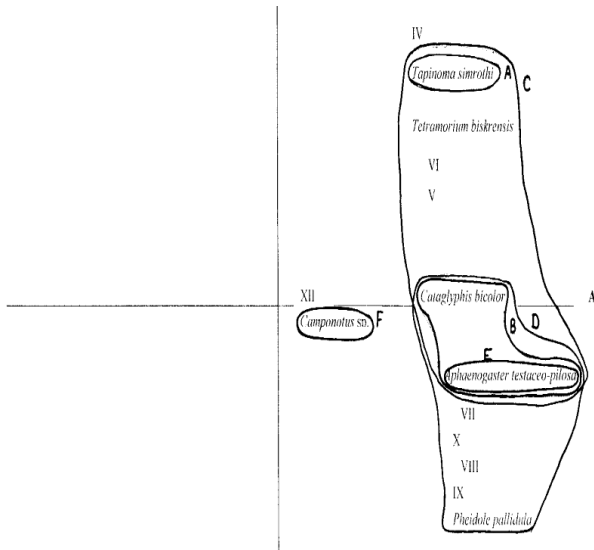


Figure 2. AFC of winged ants captured in 2006

In the case of the distribution of species as a function of the quadrants, it is to note the presence of groupings whether : The A grouping contains a single species reported in April. It is *Tapinoma nigerrimum*. The Groupement B gathers the species that occur only in May. These are *Aphaenogaster testaceo-pilosa* and *Cataglyphis bicolor*.

The cloud of points C is constituted by the species that are reported only in June. These are *Tapinoma nigerrimum*, *Aphaenogaster testaceo-pilosa*, *cataglyphis bicolor* and *Tetramorium biskrensis* (Auguste Forel) banknote 1904).

The groupement D contains the species that are scored only in July. These are *Aphaenogaster testaceo-pilosa*, *Cataglyphis bicolor* and discovered *Pheidole pallidula* (Nylander 1848).

The groupement E includes the species of *Aphaenogaster testaceo-pilosa* which is recorded only in August.

The cloud of points F is constituted by a single species of ant *Camponotus* sp. which is reported in December.

4.3.2. Factorial Analysis in function of months in 2007 This analysis aims to highlight the distribution of species of ants caught in function of the month. The contribution of the species of ants during the different months in 2007 to the total inertia is equal to 40,2 % for the axis 1 and 23,7 % for axis 2. The sum of these two rates is equal to 63,8 %. Because of this, a large information may be given through the plans determined by the pins 1 and 2 (Fig.3).

* The participation of the months for the training of axis 1 and 2 is the following:

Axis 1: The month of November (XI) with 31,3 % and those of september (IX) and October (X) with 23.8 per cent are involved the more in the construction of the axis 1.

Axis 2: The month of April (IV) with 51,1 % and that of July (VII) with 21,6 % who contribute the most in the training of the axis 2.

* The participation of the species of ants to the training of pins 1 and 2 is the following:

Axis 1: The case of *Messor barbara* which occurs the most in the formation of the axis 1 with a rate equal to 70,0 %. The other species contributing with lower rates.

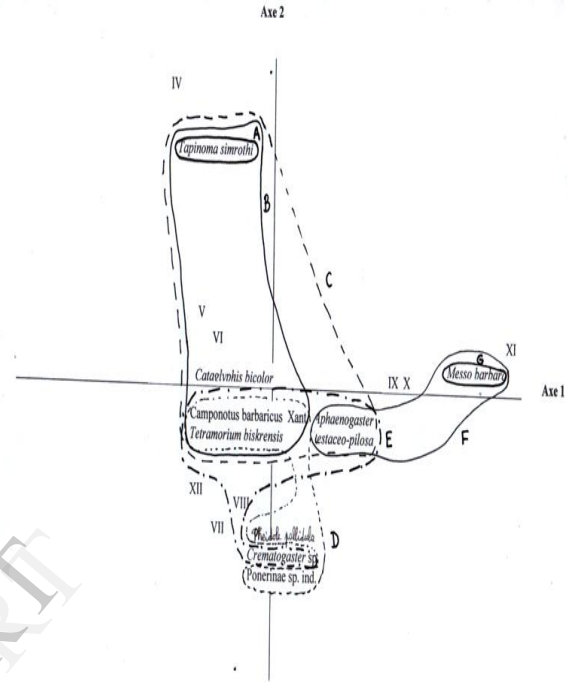


Figure 3. AFC of winged ants caught in 2007

Axis 2: *Tapinoma nigerrimum* is the species that contributed the most in the formation of the axis 2. It intervenes with 67,2 %. Other species occur with lower rates.

* Distribution of the months following the quadrants: The month of September, October and November are located in the quadrant I. In the quadrant II, it is to note the presence of the months of April, May and June. The month of July, August and December are noted in the quadrant III.

With regards to the distribution of species in function of the quadrants, it is to note the presence of groups either:

The grouping A contains a single species reported in April. It is *Tapinoma nigerrimum*.

The group B includes species that occur only in May. These are *Tapinoma nigerrimum*, *cataglyphis bicolor*, *Tetramorium biskrensis* and *Camponotus barbaricus* Xantomelas (Emery, 1908).

The groupement C is constituted by the species that are reported only in June. These are *Tapinoma nigerimum*, *Aphaenogaster testaceo-pilosa*, *cataglyphis bicolor* and *Tetramorium biskrensis* and *Camponotus Xantomelas barbaricus*.

The groupement D contains the species that are scored only in July. These are *Tetramorium biskrensis*, discovered *Pheidole pallidula*, *Camponotus barbaricus* *Xantomelas* and *Ponerinae* sp. ind (Lep.).

The cloud of points E is formed by the species that are scored only in August. These are *Aphaenogaster testaceo-pilosa*, *Tetramorium biskrensis*, *Camponotus barbaricus* *Xantomelas* and *Crematogaster* sp.

The groupement F is formed by the species which are mentioned only in September. These are *Aphaenogaster testaceo-pilosa* and *Messor barbara*.

The group G contains a single species recorded in November.

5. Discussion

5.1. Discussion on the swarming ants

Usually, the communities of ants product of winged male and female, in order to ensure the renewal of the species, and its release into the space. In the present study, we noted 10 swarming ants during the nine months from April to December during two years 2006 and 2007. It is to be noted that the wings begin to appear at the beginning of the beautiful season with a preference for the warmer months.

Tapinoma nigerrimum is the only species which begins its early spin-off, the wings of this species are observed on three months from April to June. These results are identical to those found by [2]. [5] notes the spin-off of this species in May. Then that [7] having studied the ants of the French Mediterranean region, notes the spin-off of the kind *Tapinoma* at the end of summer. This could be explained by the tolerance of this species along with the thermal requirements, or by the ubiquitous food availability. Indeed, [10] in his study on the biosystematics of Aphidae pointed out to the abundance of this species during 12 months between June 2004 and May 2005. In the same direction, Huber In (Auguste Forel, 1870) noted that aphids moderated at the same time as the ants which raise them and that when the temperature went up for a few days in winter they knew where to go and find them.

Beautiful clouds of swarms of the ant *Aphaenogaster testaceo-pilosa* are observed during 6 months from May to October for the year 2006 and 2007. These results confirm those found by [1] who noted the spin-off of this species in the months of September and October. Whereas, [2] in the park of the I. N. A., pointed to only a single individual wing at the end of June. *Cataglyphis bicolor* is a very active species, preferring the solar radiation sites. In 2006, the sexed ants are observed during the months of May, June and July. In 2007, they are observed only in month of May and June. The results obtained are similar to those found by [2] and those of [5], the latter noted the spin-off of this species in the months of June and July in the region of Algiers. With regard to the spin-off of *Tetramorium biskrensis* it has been reported

only once in June in 2006 and over four months from May to August for the year 2007.

Similarly [2] noted the winged individuals in June. Thus, [5] notes that the spin-off from this species is done in June. The sexed of *Pheidole pallidula* are captured in month of July only in 2006 and 2007. The winged are often caught the afternoon and especially at night. Also, [2] noted the winged of this species during the months of May and June. While [5] notes that the spin-off is done in the summer often by considerable mass and lasts until the first heavy rains of September and early October.

Messor barbara is captured in 2007 in September, October and November. These results confirm those of [1] which has captured the sexed of *Messor* during the same month. Similarly, [4], believes that the flight of the sexed usually among the grasses as the kind *Messor* takes place from September to November. The sexed of the species *Camponotus barbaricus xantomelas* are noted from May to August in 2007. [2] has pointed out the winged of this species in the months of July and August, outside [5] mentioned the end of the spring early summer for the spin-off from this species.

5.2. Discussion on the impact of climatic factors on the spin-off

In order to better interpret our results, we deem it useful to observe the values of temperatures, humidity and rainfall recorded in the daily weather bulletin of the E. N. S.A. regarding the dates of swarming ants captured. Since it is the most important factor in the climate, it is estimated that the temperature is the primary factor that influences on the period of spin-offs. According to [6] at the time of the nuptial flight, the male and the female ants are *photopositifs*, but become quite *photonegatifs* after mating. According to the results shown in table 1, the average minimum temperature is observed of 18.5 °C for *Tapinoma nigerimum* 04/29/07 with an average humidity of 90% and a precipitation of 4.2 mm. It is followed by a temperature of 18.9 °C to *Messor barbara* on 29/10/07. The value of the average temperature the highest recorded in the process of swarming is of 27.5 °C with an average humidity of 67.5 % recorded for the species of *Aphaenogaster testaceo pilosa* until 09/08/07. The swarming of the species *Cataglyphis bicolor* are observed between 20 to 23 °C and a humidity of 58.5 % to 95.5 % which explains that the thermal requirements differ from one species to another.

5.3. Discussion on the factorial analysis applied on winged ants

The analysis of factorial correspondence applied to species of Formicidae winged captured in 2006 has shown the existence of six groups A, B, C, D, E and F are all in the positive part of the axis 1.

In 2007, the analysis of factorial correspondence applied to spin-offs of this year revealed the presence of 7 groupings that are A, B, C, D, E, F and G. divided among the four quadrants.

The designated groupings are noted according to the months of study to which belongs the species or the whole of ants.

This difference of the months is explained by the fact, that the sets of species of Formicidae sampled differ qualitatively from one period to another. [3] has, notably, used a factorial analysis of correspondence including function in months of study, and he also noted a monthly differentiation of species of Formicidae.

6. Conclusion

Ant swarms were studied in a suburban area at a park of El-Harrach (Algiers). Swarming was observed from April to the end of December during 2006 and 2007. Accordingly the factors of climate: temperatures, humidity and rainfall lead to demarcate the various periods of spin-offs for each species of ants, the other factors remain secondary. Temperatures varied between 18,5 & 27,5°C. and relative humidity from 58,5 to 90 % during the swarming activity.

7. Acknowledgement

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8. References

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Table 3

Species	Date	T°min	T°max	Moy.	T° sol 30 cm.	T° sol 60 cm.	T° sol 1 m.	H% min	H% max	Average	Rain
<i>Tapinoma nigerimum</i>	21/06/06	20,5	27,2	23,9	25,5	25,7	24,5	80	100	90	00
	29/04/07	16,1	21,7	18,9	19,3	19,6	18,2	80	100	90	4,2
<i>Aphaenogaster testaceo-pilosa</i>	21/05/06	17,4	25,3	21,4	25,8	24,4	22	82	96	89	00
	16/07/06	20,7	27	23,9	26,5	26,4	23,8	61,1	100	85,5	00
	09/08/07	21	34	27,5	30,6	30,5	28,7	50	85	67,5	00
<i>Cataglyphis bicolor</i>	05/06/06	11,5	28,5	20	24,9	24,8	23,2	34	83	58,5	00
	30/07/06	18,2	26	22,1	28	27,8	25,5	67	95	95,5	00
	21/05/07	19,7	26	22,9	24,5	24,2	21	78	99	88,5	00
<i>Messor barbara</i>	29/10/07	15	22	18,5	20,5	21,5	22,5	80	99	89,5	9,4