

SOME REMARKS ON THE FORAGING STRATEGY IN *CATAGLYPHIS AENESCENS* NYL. (HYMENOPTERA, FORMICIDAE)

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Abstract. The frequency of exits and entries, the maximal distance of foraging trips from the nest, as well as the foraging route shape of a marked ant, in the connection with the temperature of sand were observed twice in 1981.

The number of exits of the marked ant was similar in both cases (12 and 10 times). The maximal distances were similar in both cases (10 m and 10.6 m). The marked ant spent similar time in the nest between two exits (on the average 20.25 min. and 25.3 min. respectively). There is a difference in the time spent out of the nest (13.94 min. and 21.6 min. respectively).

The marked ant shows the site-fidelity, by running in the same direction chosen by the first exit.

Key words: ant foraging strategy, diurnal activity, Deliblatska pescara.

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Introduction

This paper continues the series of works on *Cataglyphis aenescens* Nyl. (formerly called *C. cursor* Fonsc. or *C. c. aenescens* Nyl.) (Petrov 1984, 1985, 1986, 1988, 1990; Petrov and Gallé 1986).

According to its morphological and ethological characteristics such as: somewhat upward raised gaster, long legs and high running speeds, this species is adapted to arid habitats. Concerning the peculiarities of the habitats which *C. aenescens* inhabits (semidesert and desert), as well as its importance and role in such habitats, *C. aenescens* (*C. cursor*) arose interest of many authors (Cagniant 1973, 1976, 1979, 1980, 1980a, 1984; Dlussky 1962, 1981; Marikovski 1973, 1977; Reznikova 1983; Lenoir 1987; Lenoir et al. 1988; Schmid-Hempel 1987).

Since the data on foraging strategy of this species, under poor trophic conditions of semidesert and desert, are scarce (Petrov, 1990), it seemed of interest to continue relevant investigations to illustrate some aspects of the foraging mode of one desert ant species such as *C. aenescens*.

Material and methods

Investigations on the foraging mode of *C. aenescens* have been carried out in the locality Cardak (Deliblatska pescara, Serbia), about 70 km northeast of Belgrade, twice in 1981.

Both times the investigations of frequency of exits and entries, began with the first exit of the marked ant and lasted 507 minutes each. The ant was marked by using the light colour, in the afternoon of the previous day.

The foraging route and the maximal distance from the nest was established by using coloured sticks, which were pined into the sand on each 15-20 cm behind the marked ant, and drawing the routes later. Out of 22 observations of two marked ants from two different nests, it was possible to draw the routes of 13.

Result and discussion

C. aenescens, like the other *Cataglyphis* species, is strictly diurnal forager, leaving the nest individually and never undertaking mass foraging.

The first observation of July 19, began at 5.30 a.m. and lasted until 2.15 p.m. It can be noticed that the marked ant left the nest 12 times (Tab. 1). The first leaving was at 6.37 a.m., at the temperature of sand of 26 °C, and the last leaving was at 12.31 p.m., when the sand temperature was 57°C. Out of the nest, this ant spent from 2 to 26 minutes. The total out time was 167.3 minutes (13.94 min. on the average) (Tab. 1).

This ant spent from 1 to 48 minutes in the nest between two exits. the total nest time was 243 minutes (20.25 min. on the average) (Tab. 1).

The maximal distance observed was from 0.1 m to 10 m (the average 3.95 m) (Tab. 1).

The marked ant was loaded three times, or 25% of the total exits (Tab. 1). Although this ant used to find certain particles which it began to carry toward the nest, it did not bring them into the nest twice, but lost them and returned unloaded.

The second observation of August 4, was carried out between 5.30 a.m. and 2.15 p.m. The marked ant left the nest 10 times. It left the nest the first time at 6.05 a.m. at the sand temperature of 22.5°C. The last leaving was at 1.15 p.m., when the sand temperature was 62.5°C. This ant spent from 1

minute to 2 hours out of the nest. The total out time was 216 minutes (the average 21.6 min.) (Tab. 2).

This ant spent from 1 minute to 2 hours in the nest between two exits (the average 25.3 min.). The maximal distance was from 0.1 m to 10.6 m (the average 3.93 m) (Tab. 2). In this observation, the marked ant returned loaded only once.

These observations confirm some statements about the related species *C. bicolor* F. Namely, Harkness (1977) stated that *C. bicolor* on its foraging trips spent 17 minutes out of the nest on the average, and 8-24 minutes in the nest.

Wehner et al. (1983) stated "that "the foraging range of a colony can be approximated by a circular area centered around the nest". Their investigations showed that the radius of a circular area within which the ants spend the most of the time doing foraging trips, was 13 m in Greece and 32 m in Tunisia irrespective whether a food item has been found.

Their investigations on *C. bicolor* showed that the number of foraging trips was 10 runs in Greece and only 4 runs in Tunisia. They explained that with the fact that *C. bicolor* in Greece started its exits earlier in the morning and finished them later in the evening.

Table 1. Frequency of exits and entries, maximal distances, out nest and in nest time of the marked ant (19.7.1981.): food (f).

No. of exit	hours (h)	out nest time (min)	in nest time (min)	max.distance (m)	sand temp. (°C)
1f	6 ³⁷ -6 ⁴⁹	12		1.20	26
2f	6 ⁵⁰ -7 ⁰⁹	19	1	1.80	29
3	7 ¹⁵ -7 ²⁰	5	6	1.70	31
4	8 ⁰² -8 ²¹	19	42	9.00	36
5	9 ⁰⁹ -9 ²⁸	19	48	10.00	45
6f	9 ³⁷ -9 ⁴⁵	8	12	7.80	47
7	10 ³² -10 ⁴⁰	8	47	1.40	50
8	11 ²⁰ -11 ⁴⁰	20	48	2.30	56
9	11 ⁴⁸ -11 ⁵⁸	10	8	3.20	57
10	12 ⁰⁰ -12 ⁰³	3	2	0.10	56
11	12 ²⁸ -12 ³⁰	2	28	2.20	57
12	12 ³¹ -12 ⁵⁷	26	2	6.80	57
TOTAL	507 min.	167.3	243	47.50	547
\bar{x}	-	13.94	20.25	3.95	45.50

Table 2. Frequency of exits and entries, maximal distances, out nest and in nest time of the marked ant (04.8.1981.): food (f.).

No. of exit	hours (h)	out nest time (min)	in nest time (min)	max.distance (m)	sand temp.(°C)
1	6 ⁰⁵ -6 ²⁵	20		6.00	22.5
2	6 ³⁰ -8 ³⁰	120	5	10.00	25
3	8 ⁴⁷ -8 ⁴⁸	1	14	0.10	46
4	8 ⁴⁹ -8 ⁵⁰	1	1	0.20	46.5
5	8 ⁵⁰ -9 ²⁸	38	0.30	10.60	47
6	9 ⁴⁰ -9 ⁴¹	1	28	0.30	51
7f	9 ⁴⁷ -10 ¹⁵	28	6	6.50	51
8	11 ⁰⁵ -11 ¹⁰	5	50	2.80	59
9	11 ¹⁴ -11 ¹⁵	1	14	4.00	60
10	13 ¹⁵ -13 ¹⁶	1	120	3.00	62.5
TOTAL	507 min.	216	253	43.5	470.5
\bar{x}	-	21.6	25.3	3.93	47.5

A small percentage of successful foraging trips in our investigations can be explained with poor trophic conditions in habitats which *C. aenescens* inhabits (semidesert or desert), although Wehner et al. (1983) stated that in their both investigated sites (Greece and Tunisia) about half of the foragers returned with a solid prey (dead arthropod).

These investigations in some way, as well as some others, concerning the activity of workers (Petrov 1988), confirm the statement given by Harkness (1977), Dlussky (1981), Wehner et al. (1983) that at any time in a colony, there are not more than a few hundred foragers, which is the smaller part of the colony.

In the first observation, the routes of nine exits was established (Fig. 1). It is obvious that although the routes are winding, and the maximal distance is different, the marked ant always foraged in the same direction. The route shapes by its foraging trips are more or less similar (triangular, elongated, elliptic).

The first exit was different from the others. Namely, the ant wandered across the bulwark at first, and then suddenly started to run in one direction in which it ran for the rest of its foraging time.

In the second observation four routes were established (Fig. 2). On that occasion, the marked

ant went through one turf of *Festuca vaginata* on the way from and to the nest. Generally, the route shapes of this ant were almost identical. On the way out, in front of the *F. vaginata* turf, the marked ant stopped for a while, or turned around itself before it entered the turf.

It is obvious that in both cases, the minimal, the maximal and the mean distance were similar. The ants were always going in the same direction chosen by the first exit. Such a behavior of workers confirms the site-fidelity, present in ant species and mentioned by several authors (Rosengren 1977, 1977A; Harkness 1979; Wehner et al. 1983). Making its foraging trips, *C. aenescens* is hunting over the desert ground at the hottest time of the day. Like all *Cataglyphis* species, *C. aenescens* is a scavenger. Its diet consists mainly of dead arthropods (cheafly insects). Small xerophilic snails of the family *Cepaeidae* were also found to be items of its dietary resources. Plant material and plant saps account for smaller portion of dietary resources of *C. aenescens* (Petrov, 1990).

These investigations stimulate, of course, the question of navigation in this and other individually searching desert ants. That problem has not been investigated by the author up till now. But, Wehner and R aber (1979) and Wehner (1982) stated that the navigational strategies employed by *C. bicolor* are

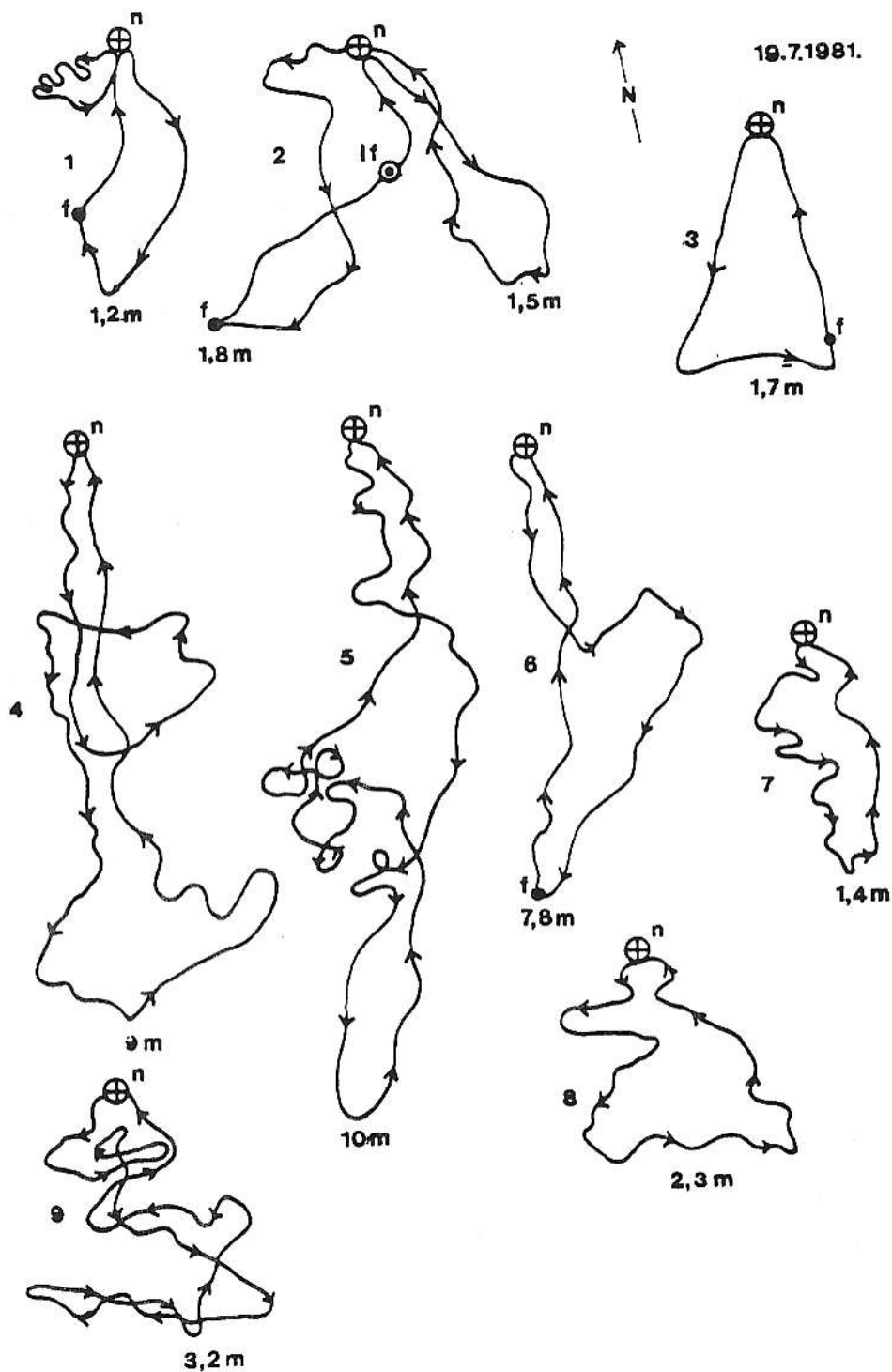


Fig. 1. Route shape and the maximal distance of the marked ant: nest (n), food (f), lost food (lf).

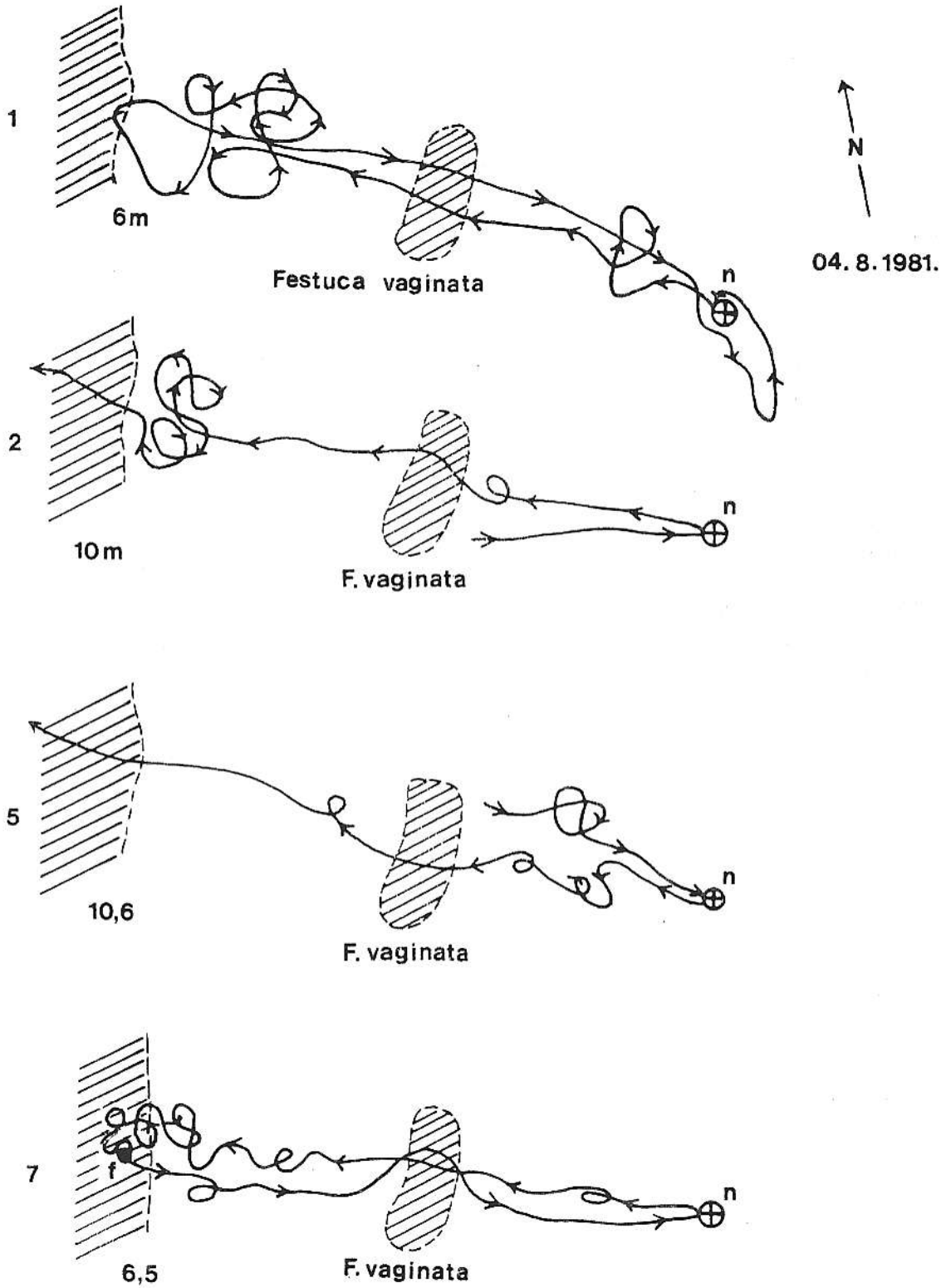


Fig. 2. Route shape and the maximal distance of the marked ant: nest (n), food (f).

"dead-reckoning (vector navigation by means of celestial compass) and piloting by landmarks". It means that "they rely nearly exclusively on visual cues including sunlight patterns and landmarks panoramas".

Conclusions

On the basis of present investigations it may be concluded that *Cataglyphis aenescens* is diurnal individually foraging desert ant.

The number of exits and entries were similar in both cases (12 and 10 times).

The maximal distances by foraging trips were similar in both cases (10 m and 10.6 m).

The average time spent in the nest between two exits of the marked ant was similar (20.25 min. and 25.3 min.).

The average time spent out of the nest was different (13.94 min. and 21.6 min.).

C. aenescens shows the site-fidelity by doing its foraging trips.

References

- Cagniant, H. (1973): Aposition d'ouvrières à partir d'aefus pondus par des ouvrières chez la Fourmi *Cataglyphis cursor* Fonscolombe (*Hymenoptera, Formicidae*). - C.A. Acad. Sc. 277, D-2197.
- Cagniant, H. (1976): Cycle Biologique de la Fourmi *Cataglyphis cursor* Fonscolombe (*Hymenoptera, Formicidae*). - Vie Milieu 24, C, 277-281.
- Cagniant, H. (1979): La partenogenese thelytoque et arrenotoque chez la Fourmi *Cataglyphis cursor* Fonsc. (*Hym., Form.*). Cycle biologique en elevege des colonies avec reine et des colonies sans reine. - Insect. Soc. 26, 51-60.
- Cagniant, H. (1980): La partenogenese thelytoque des ouvrières de la Fourmi *Cataglyphis cursor* Fonscolombe. - Insect. Soc. 27, 157-174.
- Cagniant, H. (1980a): Etude des stades larvaires, de la lignee des ouvrières des colonies avec reine et des colonics sans reine chez la fourmi *Cataglyphis cursor* Fonsc. (H., F.). - Bull. Soc. Hist. nat. 116, 192-206.
- Cagniant, H. (1984): Influence de la reine sur l'apparation des sexes et sur la ponte des ouvrières chez la fourmi *Cataglyphis cursor* Fonscolombe (*Hymenoptera, Formicidae*). - Bull. Soc. Hist. nat. 120, 99-102.
- Cagniant, G.M. (1962): Muravi sevmovich sklonov talaskogo Altana. - Trudi Inst. Zool. 18, 177-188.
- Cagniant G.M. (1981): Muravi pustinj. - Akad. Nauk USSR, Moskovskoe Obscenstvo Ispitatelie prirodi, Sekoija zoologii, Izdateljstvo "Nauka", Moscow.
- Harkness, R.D. (1977): Quantitative observations on the foraging of nests of an ant (*Cataglyphis bicolor* F.) in Greece. - Acta Entomologica Jugoslavica 13, 21-33.
- Harkness, R.D. (1979): Duration and lenghts of foraging paths of *Cataglyphis bicolor* (F.) (*Hym., Formicidae*). - Entomologist's Monthly Magazine 115, 1-8.
- Lenoir, A. (1987): Factors determining polyethism in social insects. *Experientia supplementum*, 54 - In: Pasteels, J.M. and Deneubourg, J-L. (eds.): From individual to collective behavior in social insects. Birkhäuser Verlag, Basel, Boston pp. 219-240.
- Lenoir, A., Querard, L., Pondicq, N. and Berton, F. (1988): Reproduction and dispersal in the ant *Cataglyphis cursor* (*Hymenoptera, Formicidae*). - *Psyche* 95, 21-44.
- Marikovski, P.I. (1973): O muravjah. - *Priroda* 8, 82-91.
- Marikovski, P.I. (1977): Muravi roda *Cataglyphis* v zapovednike "Pojucaja gora". - In: Poleznie nasekomie Kazastana. Alma Ata. In-ta zool. AN KazSSR, pp. 47-64.
- Petrov, I. (1984): Gradja grezna i metode preparovanja gnezda pustijnskog mrava *Cataglyphis cursor* Fonscolombe 1846 (*Formicidae, Hymenoptera*). - *Arh. biol. nauka* 36, 3P-4P, Beograd.
- Petrov, I. (1985): Idiokoloska studija vrste *Cataglyphis cursor* Fonscolombe (*Hymenoptera, Formicidae*) na Deliblatskoj pescari. - Magistarski rad, Prirodno-matematski fakultet, Beograd, pp. 1-96.
- Petrov, I.Z. (1986): Distribution of species of the genus *Cataglyphis* Foerster 1850 (*Formicidae, Hymenoptera*) in Yugoslavia. - *Arh. biol. nauka* 38, 11-12.
- Petrov, I.Z. (1988): Distribution of developmental stages and castes in the nest of the *Cataglyphis cursor* Fonscolombe (*Hymenoptera, Formicidae*) in Deliblato Sandy Area (Yugoslavia). - *Bull. Mus. Hist. nat.* 43/44, 139-149.
- Petrov, I.Z. (1990): Observations on the feeding strategy in the desert ant *Cataglyphis cursor* Fonscolombe (*Hymenoptera, Formicidae*). - *Arh. biol. nauka* 42, 83-89.
- Petrov, I.Z. and Gallé, L. (1986): Nest distribution of the ant *Cataglyphis cursor aenescens* (Nyl.) (*Hymenoptera, formicidae*) in Deliblato Sandy Area (Yugoslavia). - *Ekologija* 21, 135-148.
- Reznikova, Z.I. (1983): Mezvidovie odnosenia muravev. - AN USSR, Izdateljstvo "Nauka" Sibirskoe otdelenie, Novosibirsk.
- Rosengren, R. (1977): Foraging strategy of wood ants (*Formica rufa* group). I. Age polyethism and topographic traditions. - *Acta Zoologica Fennica* 149, 1-31.
- Rosengren, R. (1977a): Foraging strategy of wood ants (*Formica rufa* group). II. Nocturnal orientation and diel periodicity. - *Acta Zoologica Fennica* 150, 1-30.
- Schmid-Hempel, P. (1987): Foraging characteristics of the desert ant *Cataglyphis*. *Experientia supplementum*, 54. - In: Pasteels, J.M. and Deneubourg, J-L. (eds.): From individual to collective behavior in social insects. Birkhäuser Verlag, Basel, Boston, pp. 43-62.
- Wehner, R. (1982): Himmelsnavigation bei Insekten. Neurophysiologie und Verhalten. - *Neujahrsbl. Ges. Zürich* 184, 1-132.
- Wehner, R. and Rüber, F. (1979): Visual spatial memory in desert ants, *Cataglyphis bicolor* (*Hymenoptera, Formicidae*). - *Experientia* 35, 1569-1571.
- Wehner, R., Harkness, R.D. and Schmid-Hempel, P. (1983): Foraging strategies in individually Searching Ants *Cataglyphis bicolor* (*Hymenoptera, Formicidae*). - Gustav Fuschel Verlag, Stuttgart, New York, pp. 1-79.