

NOTES ON THE FORAGING OF TWO SPECIES OF PONERINE ANTS: FOOD RESOURCES AND DAILY IRJNTING AcnvmES (HYMENOPTERA, FORMICIDAE)

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ABSTRACT

Foraging activity of *Pachycondyla striata* and *Ectatomma quadridens* were studied in Rio Claro, SP, Brazil. Both the species are generalist predators. The daily hunting activities of both species were antagonic in relation to number of foragers leaving the nest, temperature and relative humidity: *P. striata* preferred the coolest and the wettest hours of the day, and *E. quadridens* preferred the warmest and the driest hours of the day.

KEYWORDS. Ant, *Ectatomma*, foraging, *Pachycondyla*, Ponerinae.

RESUMO

"Notas sobre a atividade forrageadora de duas espécies de formigas Ponerinae: fontes de alimento e horários de atividade diária (Hymenoptera, Formicidae).

Foi estudada a atividade forrageadora de *Pachycondyla striata* e *Ectatomma quadridens* em Rio Claro, SP, Brasil.

Ambas as espécies são predadoras generalistas. Os horários de atividade de coleta das duas espécies foram antagônicos em relação ao número de forrageadoras saindo do ninho, a temperatura e a umidade relativa: *P. striata* preferiu as horas mais frias e úmidas e *E. quadridens* as horas mais quentes e secas do dia para forragear.

PALAVRAS-CHAVE. *Ectatomma*, formiga, forragear, *Pachycondyla*, Ponerinae.

INTRODUÇÃO

Pachycondyla striata is a relatively large ant (13.2 to 16.7 mm) occurring in Northern Argentine, Paraguay and Brazil (South, Southeast and Central Regions) (KEMPF, 1961; KEMPF & LENKO, 1976). According to LUEDERWALD (1926) this species nests only in the soil, generally using a natural cavity. Nests may have several entrances and contain about fifty adult ants. The same author observed workers collecting larva and adult insects, spiders and earthworms, besides Miconia berries. KEMPF & LENKO (1976) observed them preying on caterpillars and millipeds.

Ectatomma quadridens is a smaller ant (10.0 to 12.0 mm) occurring from Panama to Argentina (BROWN-JR., 1958). According to KEMPF (1972) this ant occurs in all regions of Brazil, generally in areas of open vegetation such as forest edges or clearings, but also in plantations, grasslands and secondary vegetation. OVERAL (1986) observed that it nests 30 to 85 cm deep in clay soil. The nest have one to three chambers, with only one entrance, containing around 80 adult ants. It preys on arthropods in general, always capturing them on the ground. RUBIN et al. (1989) studied a colony with 800 adults.

This study aimed to identify the food item collected, observe the daily hunting activities, and some aspects of the biology on these two species of ponerine ants.

MATERIAL E MÉTODOS

Field observations on the entrance of single nest of *Pachycondyla striata* (54 hours) were carried out in 1988 (from

January to March), and *Ectatomma quadridens* (74 hoUrs) in 1989 (from January to August). The nests were localized on the peripheric urban area of Rio Claro, SP (22°25' S, 47°32' W, 612m altitude), southeastern Brazil.

The foragers flow out of and into the nests was registered. An efficiency index of the foragers was calculated as:

$$\text{Efficiency index} = \frac{\text{foragers arriving with food} \times 100}{\text{total of foragers arriving}}$$

RESULTS AND DISCUSSION

Both ant species are generalist predators (Table 1), showing no preference to any kind of food. Most of the prey collected by both species were dead insect carcasses, except for the termites, larvae in general and earthworms which were captured alive. A *P. striata* forager was seen preying on a fly, *Hermetia illucens*, and a *E. quadridens* forager preying on an ant, *Neoponera obscuricornis*. Both of them used the sting to immobilize these large preys. Termites were simply captured with the mandibles. DEJEAN & SASHINGWA (1985) have also observed that *Odontomachus troglodites* only use the sting to capture large prey, that struggles vigorously after the attack. Small prey is caught directly by the ant.

Table I. Utilization of the food resources by *Pachycondyla striata* and *Ectatomma quadridens*.

FOOD COLLECTED	QUANTITIES	
	P. <i>striata</i>	E. <i>quadridens</i>
Animal origin		
1. Arthropoda		
1.1. Insecta		
- Isoptera		
~Termitidae	29(21.0%)	7(9.9%)
- Hymenoptera		
Formicidae		
Ponerinae		
Odontomachus minutus		2(2.8%)
Neoponera obscuricornis		1(1.4%)
Dolichoderinae	1(0.7%)	
Myrmicinae	1(0.7%)	
Acromyrmex sp.	2(1.5%)	
Pheidole sp.		2(2.8%)
Formicinae		
Camponotus abdominalis	2(1.5%)	
Camponotus sp.		4(5.6%)
Fragments without "identification"	2(1.5%)	
Apidae		
Apis mellifera		5(7.1%)
- Coleoptera		
Lagriidae	2(1.5%)	
Lagria villosa	1(0.7%)	1(1.4%)
Anobiidae	2(1.5%)	
Tenebrionidae	1(0.7%)	
Curculionidae (larvae)		4(5.6%)
Chrysomelidae		
Epilachna cacica (larva)		1(1.4%)
Without identification	1(1.5%)	
- Lepidoptera (larvae)		
Pyalidae		1(1.4%)
Pseudoplusia includens	1(0.7%)	
Diatraea saccharalis	2(1.5%)	
Without identification	1(0.7%)	2(2.8%)

Table I. Cont.

FOOD COLLECTED	QUANTITIES	
	P.striata	E.quadridens
- Dermaptera		
Labiduridae	5(3.6%)	
- Diptera		
Stratiomyidae		
Hermetia illucens	1(0.7%)	
Anophelidae		1(1.4%)
- Hemiptera		
" Pentatomidae	2(1.5%)	
Lygaeidae		1(1.4%)
Without identification		1(1.4%)
- Homoptera		
Cercopidae		
Mahanarva fimbriolata	1(0.7%)	
Cicadellidae	1(0.7%)	1(1.4%)
Diaspididae	1(0.7%)	
Without identification		
- Orthoptera		
Acrididae (thorax)		1(1.4%)
Gryllotalpidae	1(0.7%)	
Tettigoniidae	1(0.7%)	
-Blattaria	1(0.7%)	
-Insect fragments	2(1.5%)	6(8.6%)
1.2. Arachnida		
- Araneae	2(1.5%)	1(1.4%)
1.3. Crustacea		
-Isopoda		
Armadillidium vulgare	1(0.7%)	
Oniscus asellus	2(1.5%)	
2. Annelida		
Oligochaeta (fragments)	23(16.6%)	
Earthworms faeces	19(13.7%)	10(14.1%)
3. Platyhelminthes		
Turbellaria		
Geoplanidae	1(0.7%)	
Animais without identification		3(4.2%)
Total of the animals	113(81.9%)	56(78.9%)

.Tâble I. Cont.

<u>FOOD COLLECTED</u>	QUANTITIES	
	P.striata	E.qua-ridens
Plant origin		
4. Seeds		
Gramineae		4(5.6%)
Carica papaya	2(1.5%)	
Without identification	3(2.2%)	1(1.4%)
5. Fruits		
alveoli of Citrus	9(6.5%)	
polp	1(0.7%)	
6. Fiber plants	6(4.3%)	7(9.9%)
7. Leaves	1(0.7%)	
8. Bulb	1(0.7%)	
9. Root	<u>2(1.5%)</u>	3(4.2%)
<u>Total of the plants</u>	25(18.1 %)	15(21.1 %)
Total of the foodresources	138	71

In spite of it do not have been Quantified, some E. quadridens foragers were observed carrying liquid drops between their mandibles, in the morning. This may represent dew or nectar. WHEELER (1986) have also observed E. tuberculatum collecting nectar.

The mean ratio load *mass/ant* mass was 0.20 in P. striata and 0.43 in E. quadridens (Table 11). It was observed a E. quadridens forager dragging with the mandibles a large prey (an *Apis mellifera* worker) in backwards into the nest. Normal sized prey were carried in forward travel in both species.

Table 11 Mass of the load carried and of the ants, and the mean ratio load *mass/ant* mass of *Pachycondyla striata* and *Ectatomma quadridens*.

Ant species	load mass	Ant mass	load <i>niass/</i> ant mass
P. striata	14.5 mg (0.4-85.0)	69.9 mg (64.0-78.5)	0.20
E. quadridens	9.7 mg (1.0-70.0)	22.3 mg (19.0-25.5)	0.43

Workers from the *P. striata* colony foraged continuously except during midday, from 09:00 to 14:00 (Fig. 1), and there was a brief pulse of increased activity in the morning, from 07:00 to 08:00h. It suggests that *P. striata* prefers the coolest (until 17°C) and the wettest (until 98%) hours of the day. Similar daily activities were observed in *E. tuberculatum* by WHEELER(1986) and in *Harpegnathos saltator* by SHIVASHANKAR et al. (1989).

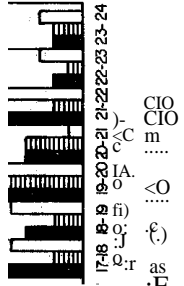
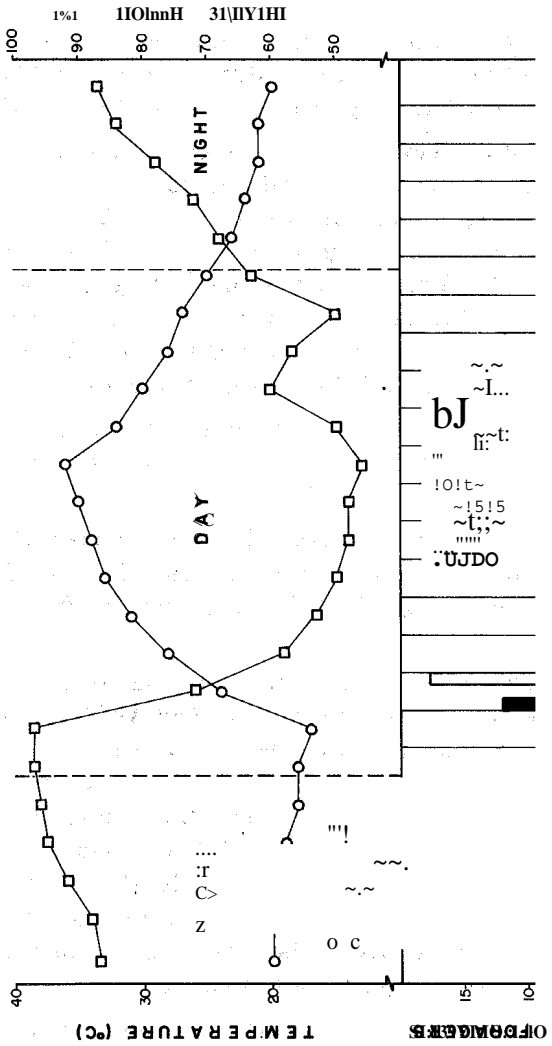
By the other hand, workers of *E. quadridens* colony preferred the warmest (until 43°C) and driest (until 46%) hours of the day (Fig. 2), halting foraging activities from 05:00 to 08:00h. OVERAL(1986) observed a totally different schedule of activities in *E. quadridens* in the State of Para, Brazil, similar to that of *P. striata*. PAIVA & BRANDÃO (1989) recorded two peaks of activities in *E. permagnum*, one between 09:30 and 11:30, and the second from 14:00 to 16:00 h., without activities at night.

Factors such as intrinsic activity rhythms and capacity to resist water loss should determine the activity schedules in each ant species.

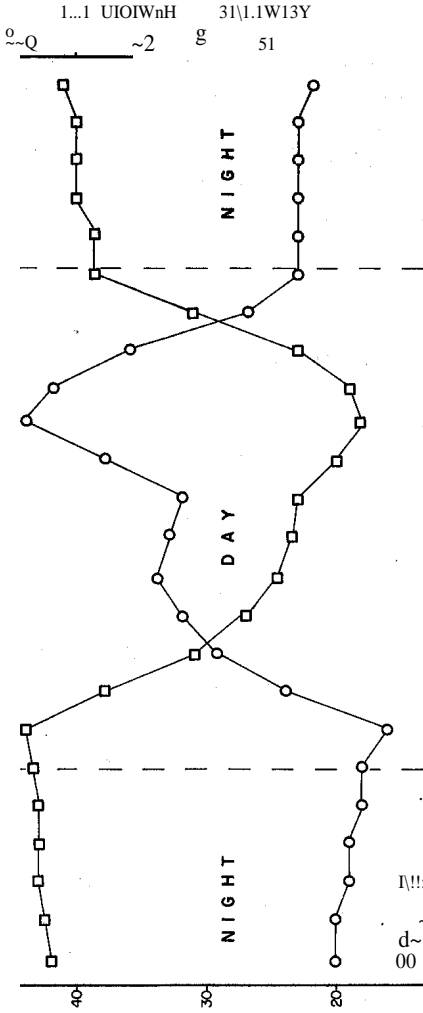
Trailing was not observed in either species. The use of visual cues seems to constitute the basis for the spatial orientation, as observed by FRESNEAU (1985) in *Neoponera apicalis*.

E. quadridens foraged individually and in 2% of the returns foragers carried a nestmate into the nest. WILSON (1971) considered this as the most primitive method of recruitment, used to recover inexperienced foragers to the nest. *P. striata* used tandem-running recruitment behaviour in either cases: to leave (6.5%) and to return (4.0%) to the nest. This behaviour has also been observed by MASCHWITZ & MULLEMBERG (1973) and HOLDOBLER & TRANIELLO (1980) in other species of *Pachycondyla* where it seems to be used for recruitment of nestmates to rich food sources or new nest sites.

The efficiency index of foraging was considered low in the two species: 27.4 in *P. striata* and 12.7 in *E. quadridens*. Individual foraging, absence of trail laying and use of primitive methods of recruitment were factors that affected these efficiency indices.



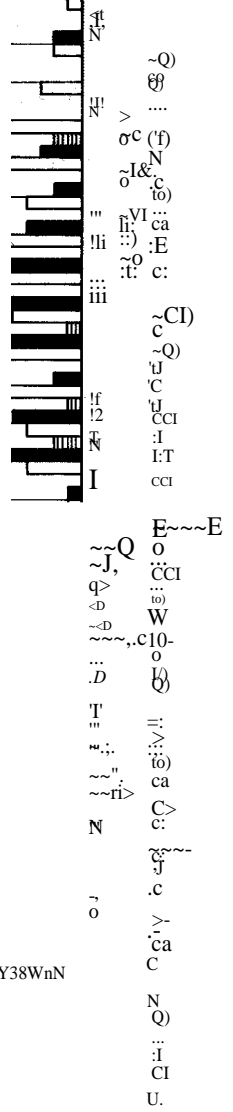
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Some additional biological data were also obtained: *P. striata* nest had 7.8 ± 2.3 holes of entrance (4 - 12) during the study period. The main hole showed 83.4% of the leavings and 92.5% of the returns. Some holes were temporarily closed but reopened later. All the holes were contained in a 70 x 10 cm area. Some unused holes were inhabited by a number of nest symbionts: the millipeds *Gymnostreptus olivaceus*, *Pseudonannolene tricolor* and *urostreptus* sp., a Salticidae spider, a Pentatomidae bug and two small Myrmicinae ants. The *E. quadridens* nest had only one opening always defended by a worker. A small Phoridae fly was observed going into the nest closely following a forager returning to the nest.

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REFERENCES

- BROWN-JR. W. L. 1958. Contributions toward a reclassification of the Formicidae. 11. Tribe Ectatommini (Hymenoptera). Bull. Mus. Comp. Zool. Harv. 118: 175-362.
- DEJEAN, A. & E. P. BASHINGWA. 1985. La prédation chez *Odontomachus troglodites* Santschi (Formicidae -Ponerinae). Insectes Soc. 32(1): 23-42.
- FRESNEAU, D. 1985. Individual foraging and path fidelity in a Ponerine ant. Insectes Soc. 32(2): 109-116.
- HOLLOBLER, J. & J. TRANIELLO. 1980. The pygidial gland and chemical recruitment communication in *Pachycondyla (=Termitopone) laevigata*. J. Chem. Ecol. 6: 883-893.
- KEMPF, W. W. 1961. As formigas do gênero *Pachycondyla* Fr. Smith no Brasil (Hymenoptera: Formicidae). Rev. Brasil. Ent. 10: 189-204.

- KEMPF, W. W. & K. LENKO. 1976. Levantamento da formicifauna no litoral norte e ilhas adjacentes do Estado de São Paulo, Brasil. I. Subfamílias Dorylinae, Ponerinae e Pseudomyrmicinae (Hym., Formicidae). *Studia Ent.* 19(1/4): 45-66.
- LUEDERWALDT, H. 1926. Observações biológicas sobre formigas brasileiras, especialmente do Estado de São Paulo. *Rev. Mus. Paulista* .14: 185-304.
- MASCHWITZ, U. & M. MUHLEMBERG. 1973. Tandemlauf ein einzigartiges rekrutierungsverhalten bei Ameisen. *Nat. Mus.* 103: 396-398.
- OVERAL, W. L. 1986. Recrutamento e divisão de trabalho em colônias naturais da formiga *Ectatomma quadridens* (Fabr.) (Hymenoptera: Formicidae: Ponerinae). *Bol. Mus. Paraense Emilio Goeldi, Zool.* 2(2): 113-135.
- PAIVA, R. V. S. & C. R. F. BRANDÃO. 1989. Estudos sobre a organização social de *Ectatomma permagnum* Forel, 1908 (Hymenoptera: Formicidae). *Rev. Brasil. Biol.* 49(3): 783-792.
- RUBIN, M.; J. P. LACHAUD & D. FRESNEAU. 1989. La structure sociale chez *Ectatomma quadridens*: comparison au sein du genre *Ectatomma*. *Actes coll. Insectes Soc.* 5: 265-273.
- SHIVASHANKAR, T.; H. C. SHARATHCHANDRA & G. K. VEERESH. 1989. Foraging activity and temperature relations in the Ponerine ants *Harpegnathos saltator* Jerdon (Formicidae). *Proc. Indian Acad. Sci. (Anim. Sci.)* 98(5): 367-372.
- WHEELER, D. E. 1986. *Ectatomma tuberculatum*: Foraging biology and association with *Crematogaster* (Hymenoptera: Formicidae). *Ann. Entomol. Soc. Am.* 79(2): 300-303.
- WILSON, E. O. 1971. *The Insectes Societes*. Belknap Press, Cambridge. 548p.