DISPERSION AND FOUNDATION OF NEW COLONIES IN *Polistes versicolor* (HYMENOPTERA, VESPIDAE).

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ABSTRACT

Dispersion and Foundation of New Colonies in
Polistes versicolor (Olivier) (Hymenoptera: Vespidae)

Pre-emergence stage of *Polistes versicolor* (Olivier) colonies was studied on the following aspects: dispersal of females, foundation of new colonies, growth of the nests, duration of the stages and lifespan of the foundresses. Shifts of females among the founding nests were considered as an attempt to usurp other nests, since hierarchies of dominance were early established in the new colonies. Shifts were facilitated by the parentage of the foundresses.

KEY WORDS: Insecta, social wasp, foundresses lifespan.

RESUMO

Foram estudados os seguintes aspectos do estágio de pré-emergência das colônias de *Polistes versicolor* (Olivier): dispersão das fêmeas, fundação de novas colônias, sucesso das colônias, crescimento dos ninhos, duração dos estágios de desenvolvimento e longevidade das fundadoras. As mudanças de ninho efetuadas pelas fundadoras foram consideradas como uma tentativa de usurpar outras colônias, uma vez que a hierarquia de dominância era estabelecida rapidamente após a fundação. As mudanças foram facilitadas pelo parentesco existente entre as fundadoras.

PALAVRAS-CHAVE: Insecta, vespa social, longevidade das fundadoras.

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INTRODUCTION

Polistes versicolor (Olivier) is a social wasp occurring since Costa Rica until south of Brazil and Argentina (Richards 1978) and much of its biology have bean studied (Rodrigues 1968, 1982, Esch 1971, Gobbi 1977, Gobbi & Zucchi 1980, 1985, Itô 1984, Valadão 1986, Carneiro 1991).

In this study we determined the dispersion and foundation patterns of new colonies of *P. versicolor*, their success, and the behavior of the foundresses in the pre-emergence stage.

MATERIAL AND METHODS

This study was carried out in the gardens of Universidade Estadual Paulista, Campus of Rio Claro, SP (22°24'36" S; 47°33'36" W), southeasthern of Brazil, in field conditions. Daily maps of the nests were made to verify the development of the brood and the enlargement of the nest. The adults were marked with model airplane dope when they were in the winter aggregation in July 1989 and repeated in July 1990, to verify their dispersion and foundation of new colonies. All the nests were built on the leaves of some plants, mainly palm and banana trees.

RESULTS

In 1989, the parental nest had 168 cells and produced 28 foundresses that founded 18 new colonies (mean 1.6 foundresses/nest). In 1990, it had 384 cells and produced 71 foundresses that founded 39 new colonies (mean 1.7 foundresses/nest). The distance between the parental nest and a new one was 7.38-6.76m (range of 1.00-19.90m.). In 1989, the 28 foundresses shared in groups of 1 to 9 wasps and founded firstly 9 colonies (Fig. 1). Afterwards, other colonies were founded and some of them, abandoned or destroyed, but the group of foundresses-sisters was the same. The main cause of nests destruction was the friction of the leaves in days with heavy rain and wind. From that 18 colonies founded from July 18 to September 11 , 6 (33.3%) were abandoned or destroyed in the egg sub stage; 10 (55.5%) in the larva sub stage; one (5.5%)in the pupa sub stage and only one (5.5%) succeeded to reach the post-emergence stage.

In 1990, the 71 foundresses shared in groups of 1 to 10 wasps and founded first 19 colonies (from July 29) and later 39 (to October 9) (Fig. 2). Twenty three (59.0%) colonies were abandoned/destroyed in the egg sub stage; 11 (28.2%) in the larva sub stage; 1 (2.5%) in the pupa sub stage; and only 4 (10.3%) succeeded to reach post-emergence stage. In total, the mean duration of the egg sub stage was 22.4; the larva sub stage 40.1; the pupa sub stage 23.2; and the total pre-emergence stage 86.2 days (Table 1). The mean size of the nest at the end of the pre-emergence stage was 30.40 cells. The mean number of cells built in the egg sub stage was 16.50; 10.33 in the larva sub stage and 3.40 in the pupa sub stage (Table 1).

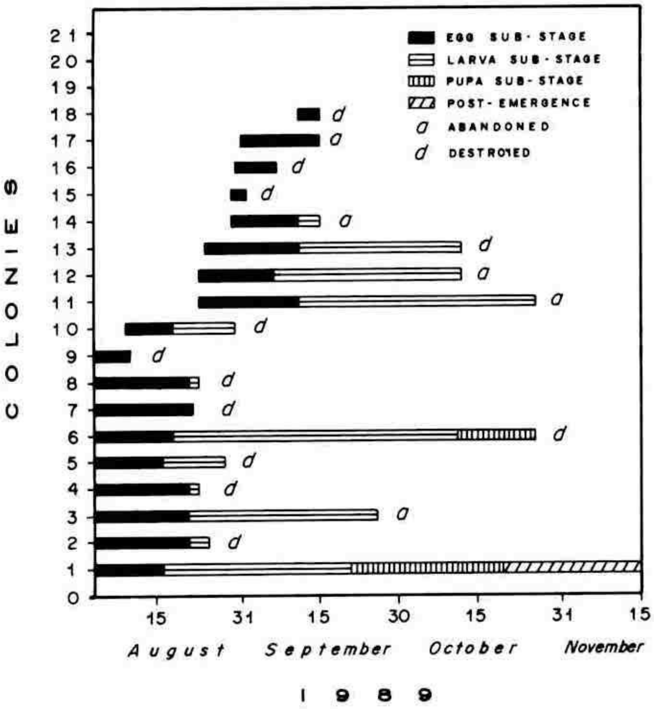

Figure 1. Development stages of the 18 colonies of *Polistes versicolor* founded in 1989 relationed with time.

Table 1. Duration (days) of the pre-emergence stage and sub stages (egg, larva and pupa), number of cells built in each sub stage, and growth rate (cells/day) of the nests in the pre-emergence stage of *Polistes versicolor.*

Sub stages	Duration (days)	Number of cells built	Growth rate (cells/day)
Egg	22.4 ± 6.2	16.5 ± 5.8	0.74
Larva	40.1 ± 7.7	10.3 ± 3.5	0.26
Pupa	23.2 ± 9.1	3.4 ± 6.1	0.15
Pre-emergence stage	86.2 ± 5.8	30.4 ± 7.5	0.35

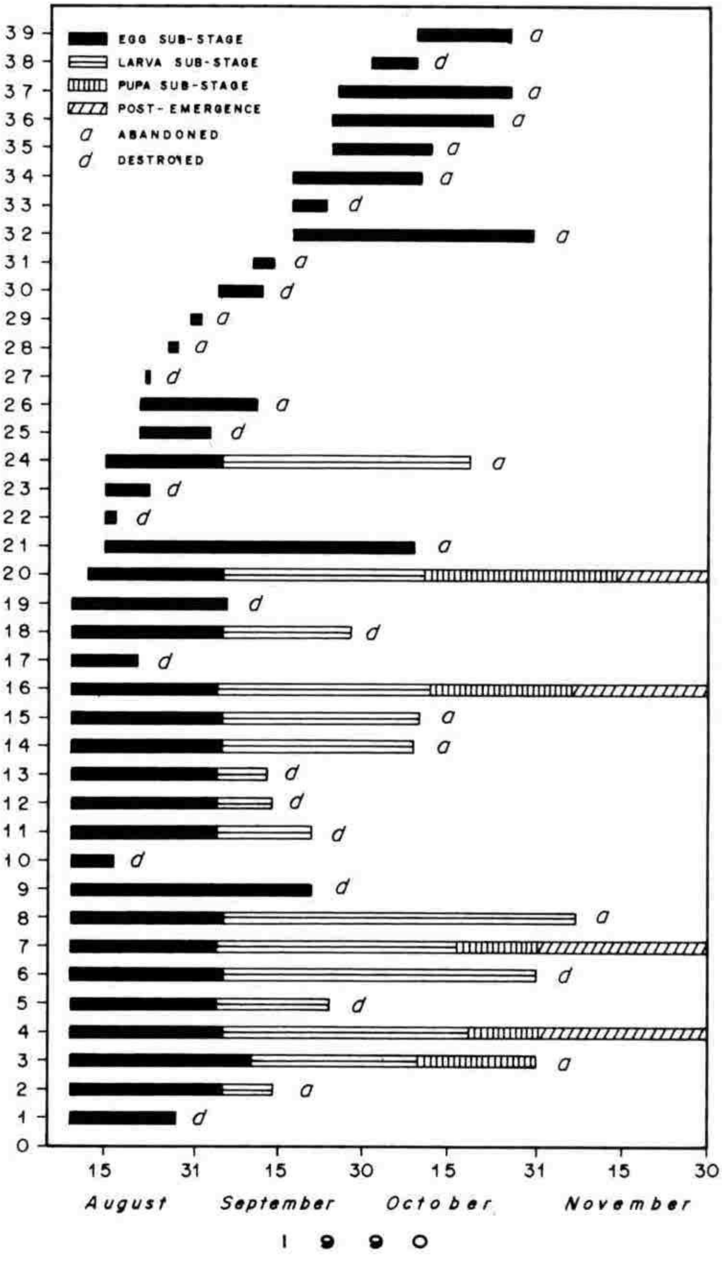

Figure 2. Development stages of the 39 colonies of *Polistes versicolor* founded in 1990 relationed with time.

It was very common the exchange of foundresses among the colonies-sisters and, consequently, the number of wasps in each nest varied. Out of the 18 colonies founded in 1989, colony one was the only which succeeded to reach the post-emergence stage and it had 4.0 foundresses in average. The Fig.4 shows the variation of the foundresses number of the 39 colonies founded in 1990. Colonies 4, 7, 16 and 20 were those which succeeded to reach the post-emergence stage and they had: 3.0, 3.2, 3.2 and 2.3 foundresses in average, respectively. (Fig. 4). The estimative of the foundresses longevity was 87.04 ± 44.92 days (26-274, n=28) in 1989 and 71.87 ± 52.22 days (9-243, n=71) in 1990.

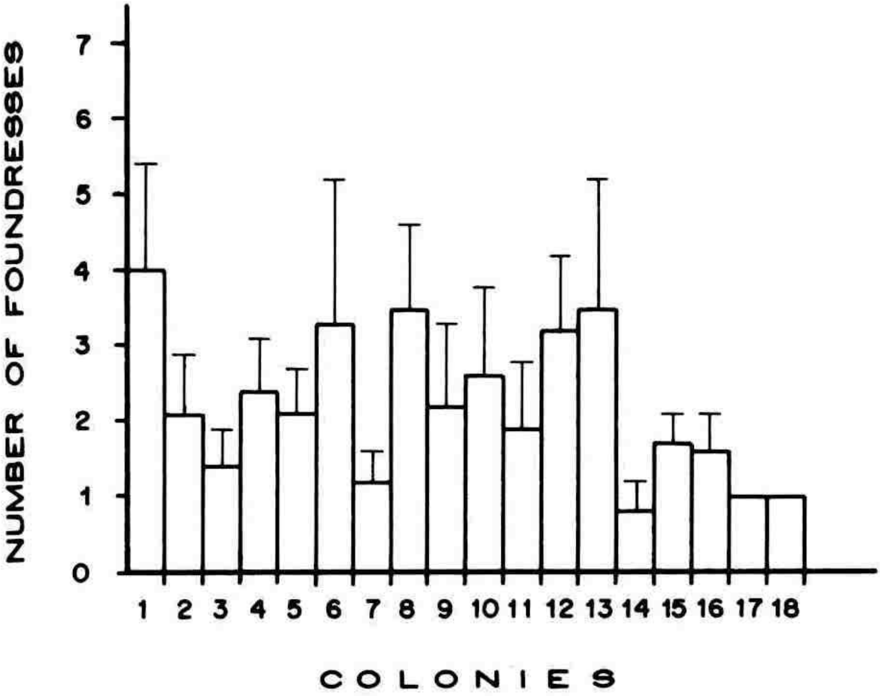

Figura 3. Mean number of foundresses per colony of *Polistes versicolor* founded in 1989.

A group of 12 foundresses was considered dominant under other group of 16 wasps. The dominant group of wasps moved 2.08 ± 2.23 times (0-6) of nest and left the nest 1.42 ± 1.44 times (0-4). The wasps of the subordinate group changed 4.19 ± 3.56 times of nest (0-13) and left the nest 3.13 ± 2.16 times (0-7). The U-Mann-Whitney test showed that the difference of the movings of nests between dominants and subordinates was not significant (Z=1.62) and the difference of the leaving nests was significant (Z=2.16).

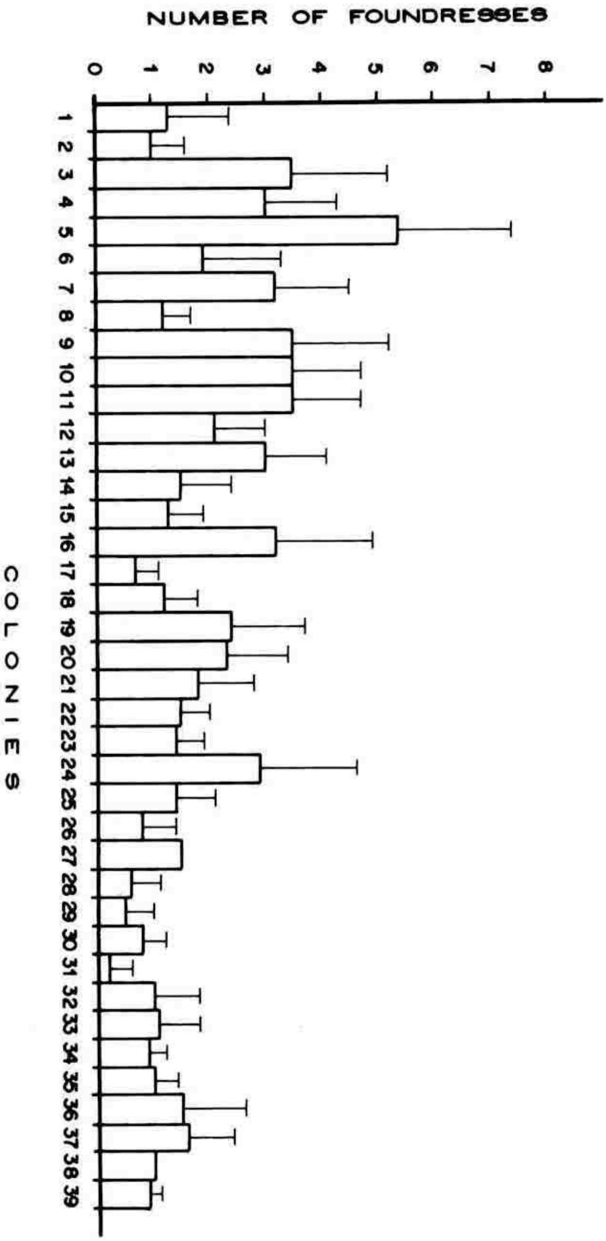

Figura 4. Mean number of foundresses per colony of *Polistes versicolor* founded in 1990.

DISCUSSION

Gobbi (1977) and Gobbi & Zucchi (1980) revealed that *P. versicolor* colonies present no correlation between colonial cycle and season, but they are influenced directly by the climatic conditions. Females from colonies declining between May and June gather together in aggregates and will start the activities only after the winter season. These aggregates are compounded mostly by fecunded young females (Rodrigues 1968, 1982, Gobbi 1977), which certainly are sisters. A number of papers suggested that there is a tendency of sisters to found new nests together (West-Eberhard 1969, Klahn 1979, Shellmann & Gamboa 1982, Post & Jeanne 1982, Pfenning *et al.* 1983), and the recognition of nestmates would depend on the odours, in part acquired in the nest and in part inherited (genetical odours) (Shellmann & Gamboa 1982, Pfenning *et al.* 1983, Bornais *et al.* 1983, Gamboa *et al.* 1986, 1987, Gamboa 1988). In this study, the shifts of females among the new nests of *P. versicolor* could be explained by the parentage of the foundresses. Then, they could tolerate themselves due their similar odours acquired in the parental nest. But it was observed that these shifts have not altered the hierarchies of dominance in the colonies. Rodrigues (1968) and Itô (1984) had already verified shifts of females among founding nests of *P. versicolor*. Subordinate foundresses cooperate in the building of more than one nest. We believed these females try to usurp other nest, although they had not succeeded, because no usurpation was observed in this study. The hierarchies of dominance were early established in the new colonies and the dominant foundresses left the colony just when their nests were destroyed. As the destruction rate was high, the difference in leaving of nests between dominant and subordinates was not significant.

Klahn (1988) and Makino (1989) studied usurpation in two species of *Polistes* and verified that the usurpers displaced foundresses which did not refound their colonies after losing their nests. In *P. versicolor*, besides this situation, the foundresses try to usurp other nests when they lose the rank of principal egg layer.

Miyano (1980) concluded that the pre-emergence stage is the most critical period for the survival of the colonies in *P. chinensis antennalis* because 41.4% of the 162 founded colonies produced sexual forms. This was a high survival rate comparing to 5.5% and 2.8% observed by Rodrigues (1968) and Gobbi (1977), respectively in *P. versicolor*. Gobbi (1977) affirmed that the initial pleometrosis (foundresses association) and brood presence were sufficient to enhance colonial success. All the colonies that succeeded to reach the post-emergence stage were founded by a foundress association (Figs. 3 and 4). Gibo (1974, 1978), Hermann *et al.* (1975), Gamboa (1978, 1980) and Hirose & Yamasaki (1984 b) observed that colonies of *Polistes* originated by foundresses associations showed higher success probability and productivity than those founded alone. Nest size increased more rapidly in the egg sub stage (growth rate= 0.74 cells/day) than in the larval (0.26 cells/day) or pupa sub stage (0.15 cells/day), as it was observed by Kojima (1989) in *Ropalidia* *fasciata*. Growth rate of the pre-emergence stage was 0.35 cell/day (Table 1).

Dispersal distances of females for colony founding in *P. versicolor* were not so long. The results showed that the foundresses had a tendency to start their new colonies near the parental nest, like other species of *Polistes* (Klahn 1979, Strasmann 1983, Hirose & Yamasaki 1984a). The independent foundation pattern of *Polistes, Mischocyttarus, Parapolybia* and part of *Ropalidia* demands a great number of foundations in a restrict area, opposite to the swarming Polybiini that founds only one colony far from parental nest.

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