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FLYING CAPACITY OF SWARM-FOUNDING WASP *Polybia occidentalis occidentalis* OLIVER, 1791 (HYMENOPTERA, VESPIDAE)

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ABSTRACT: This paper aims to estimate the flying capacity of the social wasp *Polybia occidentalis occidentalis*. Ninety six individuals from six different nests were marked and liberated, at pre-determined distances. This species is able to fly as long as 300m from their nests. However, we assumed that 70% return rate as representative of the most effective distance where the wasps realized foraging flights. According to the logistic model, the distance that allows for the 70% of return rate was 126m. It can be estimated that *P. occidentalis occidentalis* develop its activities more efficiently within a radius of 62m from the nests. This represents a foraging area per colony of approximately. 12.500m^2.

Key words: Social wasp, nest return, Epiponini.

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INTRODUCTION

The importance of the social wasps is directly related to the trophic behavior of these organisms, since all of then are predators, and use in at least some phase of their life history basically food of animal origin, mainly insects.

The alimentary spectrum of *Polybia occidentalis occidentalis* Oliver, 1971 is much variable (GOBBI *et al*., 1984) and as other generalist predators does, it presents higher levels of predation on those arrested more abundant. *P. occidentalis occidentalis* preys on several agricultural pests (MACHADO, 1977; GRAVENA, 1983; GOBBI, 1984).

In order to use social wasps in programs of Integrated Pest Management (IPM), it is necessary to know some aspects of the biology of the species. *P. occidentalis occidentalis* shows several characteristics that qualifies it as a potential agent of pest control: its relatively law aggressive behavior (MARQUES, 1989), which enables one to transfer its nest easily (MACHADO, 1977), and presents actively predates on several agricultural pest (WEST-EBERHARD *et al*., 1995).

The knowledge of the flight capacity of a wasp constitutes a fundamental step for a better understanding of the biology of a species, and is the main factor of importance for its use in programs of pest control. Knowing the capacity flight of a species we can estimate its foraging area. In spite of this, few works have been accomplished in this area, making an appointment for Brazilian studies with just three species: *Polistes canadensis canadensis* (SANTOS *et al*., 1994), *Polybia scutelaris* (MACHADO & PARRA, 1984) and *Polistes versicolor* (GOBBI, 1977).

Several studies have been carried out on ecology of *P. occidentalis occidentalis* (MACHADO, 1977), mainly on the foraging ecology; division of labor and forager specialization (O'DONNEL & JEANNE, 1990), seasonality of prey used (GOBBI *et al*., 1984), materials used, and young and adults diets (HUNT *et al*., 1987).

This paper aims to estimate the range of action of *P. occidentalis occidentalis*, by the nest return capacity, contributing to the increase the knowledge on the biology of a potentially useful species.

MATERIAL AND METHODS

This study was carried out in Feira de Santana (12º 58' S; 38º 58' W Gr.) Bahia State, Northeast Brazil, from November, 1996 to February, 1997. The colonies of *Polybia occidentalis occidentalis* which were used in this study came from the *Campus* of the Universidade Estadual de Feira de Santana, where the species is quite common.

Were utilized 96 individuals from six different nests of *P. occidentalis occidentalis*. The wasps was captured directly in their nests. The collections were made by using plastic recipients, placed in the way the nests were totally involved. Through fast movements of the recipient against the walls of the nests wasps were impelled to fly and then they were trapped. The captured individuals were submitted to anesthesia under temperature of negative 15ºC during five to ten minutes (SANTOS *et al*., 1994). After having been anesthetized, the insects were individually marked, being used ink of a lacanitrocelulose base. Other similar studies have used different methodology (chemistry methodology) in order to anesthesia of the wasps (MACHADO & PARRA,1984; GOBBI,1978)

After they have recovered the flight conditions, which was observed by the movement of the wings, the wasps were liberated, at distances of: 50, 100, 150, 200, 250 and 300m, measures in straight line starting from the nests. Two nights after the liberation of this occupants, nests were collected to the direct count of the amount of individuals which have come back.

In order to produce a model to describe the relationship between the proportion of nest returning wasps and the distance, we used the Logistic regression method (HOSMER & LEMESSHOW, 1989). This model allows to test for dependency of a binary variable (in this case, the return of each wasp) on a quantitative variable (the distance). The statistical significance of the parameters was tested by using maximum-likelihood Chi-square statistic. The Logistic model is described by the equatio:

$$P(y=1) = \frac{e^{a+bx}}{1+e^{a+bx}}$$

Where:

P = Probability of wasp return

e = neperian number

a, b = equation parameters, b represent the intensity of effect of the distance on the return probability

x = distance from the nest

RESULTS AND DISCUSSION

There is a clear decrease in the *Polybia occidentalis occidentalis* nest return rate as the distances from the nest increase (Figure 1). The lowest return rate observed during this study was 24.1% at 300m from the nest. The logistic model has been a good description of the observed data (χ^2=13.935; gl=1 p<0.001).

$$P(y=1) = \frac{e^{(2.0628 - 0.0096486).\ \text{distance}}}{1+e^{(2.0628 - 0.0096486).\ \text{distance}}}$$

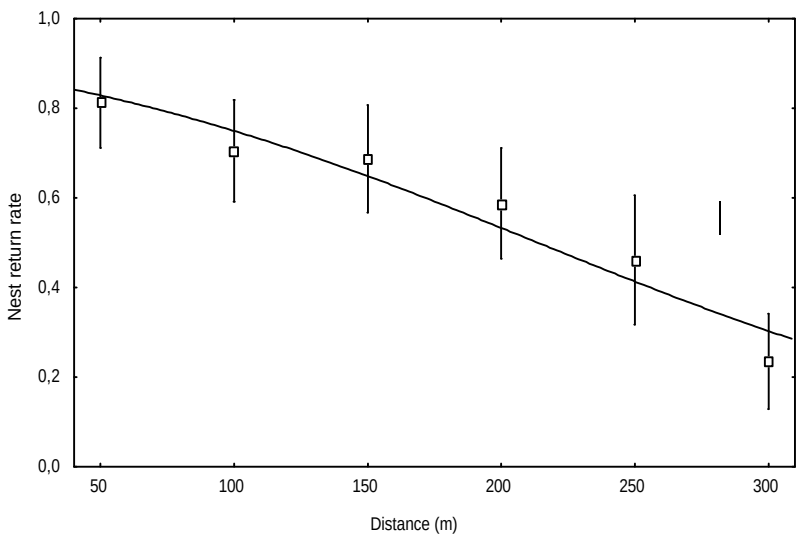

Figure 1 – Nest return rate of *Polybia occidentalis occidentalis* in Feira de Santana city, Bahia State, Brazil. The bars represent the standard error.

It is very difficult to determine clear boundaries for the flight capacity of a given species. Every choice is arbitrary. Here we used the logistic model to determine a more objective boundary selection for the flight capacity of this species. We assumed that a distance that determine a return rate of 70% could be used as an acceptable limit. Nevertheless, the use of the logistic model allows to the researcher or another person interested in management strategies for pest control to use other limits or interpretations of the results. A 70% return rate assumed here could represent the most effective protective actions of this wasp on pest species presented on at the crop. According to the logistic model, the distance that allows for the 70% of return rate was 126m.

It can be estimated that *P. occidentalis occidentalis* develops its activities more efficiently within a radius of 62m from its nests. This represents a foraging area per colony of approximately 12.500m^2. This model is, of course, full of simplifications. The flight capacity was affected for other variables, as such weight load, habitat heterogeneity, and prey density, among others.

Our results are very close to that which were found by MACHADO & PARRA (1984) for the return capacity to the nest of *Polybia scutelaris* (150m), a species morphologically very close to *Polybia occidentalis*.

SANTOS *et al*. (1994), working on *Polistes canadensis canadensis*, have obtained 250 meters as the capacity of flight of this wasp, and 125m as its range of action. GOBBI (1978) obtained 300m as the capacity of flight of *Polistes versicolor.*

It seems there to be a relationship between wasps body size and the distance that the species are capable to fly. *P. canadensis canadensis* and *P. versicolor* are larger and present larger range of action than *Polybia scutelaris* and *P. occidentalis* (GOBBI, 1978; MACHADO & PARRA, 1984; SANTOS *et al*., 1994). That corroborates the ideas of DINIZ & KITAYAMA (1998), for those authors the species with larger body size can fly at great distances of its nests.

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