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SOCIAL WASPS (HYMENOPTERA: VESPIDAE) NESTING IN EUCALYPTUS PLANTATIONS IN MINAS GERAIS, BRAZIL

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ABSTRACT

Social wasp colonies can be transferred to agroecosystems in order to control pest populations. Some failures of such transfers are common because wasps may abandon the nest immediately after the colony's transfer. Knowing the nesting habits of wasps in agroecosystems could improve the success of colony transfer during wasp management. Thus, we recorded social wasp nests in a eucalyptus plantation in Minas Gerais State, Brazil. In monthly samplings in a eucalyptus plantation throughout the year, colonies of social wasps were recorded, including *Apoica pallens* (Fabricius, 1804), *Mischocyttarus drewseni* (Saussure, 1857), *Polistes simillimus* (Zikán, 1951), *Polybia ignobilis* (Haliday, 1836), *Polybia occidentalis* (Olivier, 1791), *Polybia platycephala* (Richards, 1951), *Polybia sericea* (Olivier, 1791) and *Protopolybia exigua* (Saussure 1854) (Hymenoptera: Vespidae). Each wasp species was found in nests attached to a eucalyptus tree, 0-3 m high above the ground, or on the grass or directly on the ground. This information could be used to improve wasp management to agroecosystems.

Key Words: IPM; Polistinae, Vespidae, pesticides, biological control

RESUMO

Vespas sociais podem ser transferidas para controlar populações de pragas. Durante a transferência, falhas são comuns, pois algumas vezes vespas abandonam as colônias imediatamente após a transferência. Conhecer os hábitos de nidificação em agroecossistemas pode melhorar o sucesso na transferência de colônias durante o manejo de vespas.

Amostragens mensais em uma plantação de eucalyptus permitiram o registro de colônias de vespas sociais, entre elas: *Apoica pallens* (Fabricius, 1804), *Mischocyttarus drewseni* (Saussure 1857), *Polistes simillimus* (Zikán, 1951), *Polybia ignobilis* (Haliday, 1836), *Polybia occidentalis* (Olivier, 1791), *Polybia platycephala* (Richards, 1951), *Polybia sericea* (Olivier, 1791) e *Protopolybia exigua* (Saussure, 1854) (Hymenoptera: Vespidae). Cada espécie de vespa foi encontrada entre 0-3 m de altura em relação ao solo, os ninhos fixados em árvores de eucalipto, na grama ou diretamente no solo. Essas informações podem ser utilizadas para melhorar o manejo de vespas sociais para agroecossistemas.

Palavras Chave: MIP; Polistinae, Vespidae, pesticidas, controle biológico

Adult social wasps are usually found in agroecosystems (silvipastoral system: Auad et al. 2010, guava: Brugger et al. 2011) where they control pest populations such as lepidopteran caterpillars (Raveret & Richter 2000; Prezoto et al. 2006; Pereira et al. 2007; Bichara-Filho et al. 2009; Fernandes et al. 2010; Picanço et al. 2010). This motivates their use in biological control programs. For example, colonies of the social wasp, *Polistes simillimus* Zikán, 1951 (Hymenoptera, Vespidae) have been transferred to maize plantings to control *Spodoptera frugiperda* J. E. Smith (Lepidoptera: Noctuidae) caterpillars (Prezoto & Machado 1999).

Eucalyptus spp. (Myrtales: Myrtaceae) plantations are widespread throughout Brazil in which lepidopteran caterpillars are among their major pests (Zanuncio et al. 1993). Adult social wasps

have been reported in these plantations (De Souza et al. 2011). However because previously studied eucalyptus plantations were surrounded by native vegetation that could potentially host wasp colonies, it was not known whether wasps nest or just forage in eucalyptus plantations. Knowing the nesting habits of wasps in agroecosystems could improve the success of colony transfers during wasp management. Thus, we studied and recorded social wasp nests in a eucalyptus plantation in Minas Gerais State, Brazil.

MATERIALS AND METHODS

Social wasp colonies were observed from Mar 2008 to Feb 2009 in a eucalyptus plantation in the municipality of Juiz de Fora, Minas Gerais

State, Brazil (S 21° 47' W 43° 38', 730 m asl). This area contained approximately 7 ha of the eucalyptus hybrid, *urograndis* (*Eucalyptus grandis* × *Eucalyptus urophylla*). Eucalyptus plants were approximately 2-10 m in height and were interspersed with other plant species. No pesticide treatment had been applied during the last 5 yr before the study period.

Colonies of social wasps were sampled monthly during a 5-h period, from 10 a.m. to 3 p.m. Two observers walked in the same search path retraced each mo, inspecting the crop, leaves, termite nests, rocks and any other place where wasp nests could be located. The substrate to which the nest was attached and the height of the nest above the ground were recorded for all nests. For wasp species identification, 3 individuals were collected from each colony.

The Rayleigh test (Z) for circular distribution (Zar 1996) was applied to test whether active colonies of social wasps had a uniform distribution in the eucalyptus plantation throughout the year. The Z value is calculated using the formula $Z = nr^2$, where n is the number of observations and r is the mean vector length regarding data distribution. A long mean vector (which results in a high Z value) means a higher concentration (C) of the data around the average and, therefore, that the data are less likely to be uniformly distributed. The null hypothesis is that active nests occur uniformly throughout the year. The distribution of frequency of active colonies was plotted as a circular plot for monthly intervals with 12 mo of the yr corresponding to the 360° circumference of the plot.

RESULTS

In total, 21 colonies of 4 genera and 8 species of social wasps were recorded (Table 1). Al-

though social wasps were found nesting in the eucalyptus plantation in all mo, the frequency of active colonies varied (Fig. 1, $Z = 11.97$, $P < 0.05$, $C = 31\%$). The number of active colonies also varied per month for each species recorded. Active colonies of *M. drewseni* and *P. platycephala* were found in 10 and 9 mo, respectively; *P. simillimus*, *P. ignobilis* and *P. occidentalis* in 6, 5 and 5 mo, respectively and those of *A. pallens* only during 3 mo of the yr. The mo of occurrence in the eucalyptus plantation of *Polybia sericea* and *P. exigua* could not be analyzed because only abandoned nests of these species were found (Table 1).

DISCUSSION

Social wasps build nests within the plantation. This demonstrates that wasps in addition to foraging (De Souza et al. 2012) can nest in the plantation, too. This has not been reported probably because survey of wasps in eucalyptus has been done with traps, and the active search for wasps have been focused on adults, instead of on nests (De Souza et al. 2012). By knowing the niches where wasps nest in the plantation, we can improve the colony transfer method, which is faced with some degree of failure. For example, the rate of success of transfer of *Polistes versicolor* colonies to plastic shelters fixed onto tree trunks in a eucalyptus plantation was 85% (Elisei et al. 2012). Colonies of *P. simillimus* were transferred to a sugarcane monoculture into wooden shelters fixed on the sugarcane stalks, and the rate of success of the transfers was 85% (Prezoto & Machado 1999b). We suggest that wasp colonies should be transferred to the same niches they are naturally select in the plantation. For example, *P. simillimus* should be placed in eucalyptus trees at 1-2 m above the ground.

TABLE 1. NUMBERS OF NESTS OF VARIOUS SPECIES OF SOCIAL WASPS FOUND IN A EUCALYPTUS PLANTATION IN JUIZ DE FORA MUNICIPALITY, MINAS GERAIS, BRAZIL EACH MONTH FROM MAR 2008 TO FEB 2009.

Species	J	F	M	A	M	J	J	A	S	O	N	D	Height above the ground (m)	Substrate to which nest was attached
<i>Apoica pallens</i> (2)	0	0	0	0	0	0	0	0	0	1	1	1	0-2	Euc
<i>Mischocyttarus drewseni</i> (8)	0	0	2	2	2	5	5	5	4	4	4	4	0-2	Gra
<i>Polybia ignobilis</i> (1)	0	0	0	0	1	1	1	1	1	0	0	0	0-1	Gro
<i>Polistes simillimus</i> (1)	1	1	0	0	0	0	0	0	0	1	1	1	1-2	Euc
<i>Polybia occidentalis</i> (1)	0	0	1	1	1	2	2	1	0	0	0	0	4-5	Euc
<i>Polybia platycephala</i> (6)	3	3	3	2	0	0	0	3	3	4	4	4	0-1	Gras; Euc
<i>Polybia sericea</i> (1)	0	0	0	0	0	0	0	0	0	0	0	0	0-1	Gro
<i>Protopolybia exigua</i> (1)	0	0	0	0	0	0	0	0	0	0	0	0	2-3	Euc
Total number of nests	4	4	6	5	4	8	8	10	8	10	10	10		

Abbreviations: Euc = Eucalyptus, Gra = Grass and Gro = Ground.

Note #1. In parenthesis are shown the number of nests.

Note #2. We found 1 nest each of *Protopolybia exigua* and *Polybia sericea* but they were not included in the monthly columns because these nests had been abandoned.

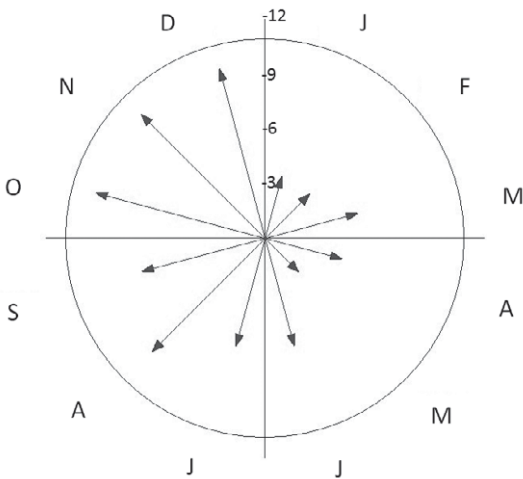


Fig. 1. A circular-linear plot of the monthly frequencies (arrows) of active colonies of social wasps in a eucalyptus plantation in Juiz de Fora Municipality, Minas Gerais State, Brazil. The 12 mo of the yr correspond to the 360° circumference of the plot.

The presence of active colonies of social wasps in the eucalyptus plantation indicates that these insects can act as natural enemies throughout the year. Active colonies were most frequent from the end of the cold-dry season to the beginning of hot-humid season. This also correlates to the time of year when the abundance of prey in agricultural settings is high (Zanuncio et al. 1993) and can potentially explain the higher frequency of wasp colonies during this period.

We highlight that social wasps adapt readily to some plantation habitats, such as eucalyptus, where they can be found naturally. Moreover wasp colonies can maintain themselves in the plantation, and probably found new colonies after their first introduction. This would save costs with respect to the reintroduction of these valuable natural enemies in pest management programs.

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