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SHORT NOTE

Temporal Activity Patterns and Foraging Behavior by social wasp (Hymenoptera, Polistinae) on Fruits of *Mangifera indica* L. (Anacardiaceae)

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Abstract

This study had as objective to determine which species of social wasps visit mango fruits, to record the behaviors displayed by them while foraging and to verify which the species of wasps visitors offer risk of accidents to farmers. The studied area was monitored during February 2012, from 8:00 to 17:00, in a 144 hour effort, and the data collected included the time of activity, wasps diversity, aggressiveness and the general behavior of social wasps around the fruits. There were registered a total of 175 individuals of 12 different species. Social wasps damaged the healthy fruits, and we registered the abundance and richness peaks during the hot period of the day. This study indicated the need for special care during the harvest, as aggressive wasps are indeed present and abundant, resulting in a possible increase of accident risk for the workers.

Foraging of social wasps comprises a collection of the following resources: carbohydrates (used mainly for adult diet), animal protein (used for immature diet), plant fiber (used for nest building), and water (used for cooling and building the nest) (Hunt, 2007, Prezoto et al. 2008, Elisei et al. 2010, Clemente et al. 2012).

While foraging for these resources, social wasps show a generalistic and opportunistic behavior, and evidence of foraging optimization. This behavior has been documented in wasps foraging on different fruit species, such as grapes (Hickel & Schuck 1995), cacti (Santos et al 2007b), jabuticaba trees (De Souza et al. 2010), cashew trees (Santos & Presley 2010), guava trees (Brugger et al. 2011), pitanga trees (Souza et al 2013), and Spanish prune (Prezoto & Braga, 2013). In these studies, the authors reported that the wasps might prey on crop pests that damage fruits to collect carbohydrates.

Despite the growing number of studies on social wasps in the past decade, information on the role of these insects in orchards is still scarce, despite these insects having their highest diversity in the Neotropics (Rafael et al. 2012). Hence, there is a need for studies that answer questions such as: Which species of social wasps forage on fruits? What types of behavior do they display? Do wasps offer risk of accidents to fruit farmers?

This study aims to increase the knowledge about the occurrence of social wasps on mango tree plantations and to describe the richness and abundance of social wasps that forage on fruits throughout the day, as well as to describe the behaviors displayed by them while foraging.

The study was conducted in a farm in the municipality of Juiz de Fora, Zona da Mata Mineira (21°43'55"S, 43°22'16"W, 800 m a.s.l.). Observations were made in February 2012, during the fruiting of mango trees, from 8:00 to 17:00, in a total of 144 h of observation. For each observation event, we established 4-m² quadrants on the base of trees to record visiting wasp and their behavior (*ad libitum sensu* Altmann 1974) during foraging on fallen fruits. All were record by direct observation.

To record behavioral information we defined four types of arrival behavior of wasps on fruits: (I) direct landing on fruit, (II) hovering before landing on fruit, (III) hovering over other fruits before landing, and (IV) landing elsewhere and moving to the fruit. After observation, wasps were collected with an insect net for identification, using for genera and species keys proposed by Richards (1978) and Carpenter & Marques (2001), vouchers were deposited in the Laboratory of Behavioral Ecology and Bioacustics at the Federal University of Juiz de Fora (LABEC).

We also classified behavioral displays in the presence of other insects as: no aggressive behavior (the wasp remained on the fruit even after being touched by other insects); aggressive behavior (attack or threat to other insects landed on the fruit). For the correlation test between richness and abundance of social wasps we used the Pearson coefficient test (r). We also determined the Berger-Parker index of dominance in R 3.0 (Freeware).

We recorded 175 individual wasps of four genera and 12 species foraging on mango fruits (Table 1). Most species (87.8%; n = 9) were swarm-founding wasps (whose nests are founded by a swarm composed of tens of queens and hundreds of workers), which have large biomass, and, therefore, need a large amount of food. These species form large colonies, which makes their local abundance higher than that of species of independent foundation (whose colonies may be founded by one or a few wasps) and may determine resource consumption. These studies corroborate studies carried out in areas of eucalyptus plantations (Ribeiro Junior 2008), silvopastoral systems (Auad et al. 2010), rainforests (Souza & Prezoto 2006), and arid (Santos et al 2009) and island environments (Santos et al 2007a) in which swarming species were more abundant than species of independent foundation.

The abundance peak occurred from 10:00 to 14:00h (Fig. 1). There was a positive correlation between abundance and the warmest times of the day (r = 0.7635; *P* = 0.0062). These results corroborate studies on social wasp foraging, in which the activity peak of wasps was observed in the warmest times of the day (Rezende et al. 2001; Elisei et al. 2010; Bichara Filho et al. 2010; Castro et al., 2011). There was no wasp visit from 14:30 to 17:00h. We believe that this may have occurred, because after 14:00h there was shading on fallen fruits, causing a decrease in the temperature in this environment and probably interfering in the foraging of wasps. The species *Polybia*

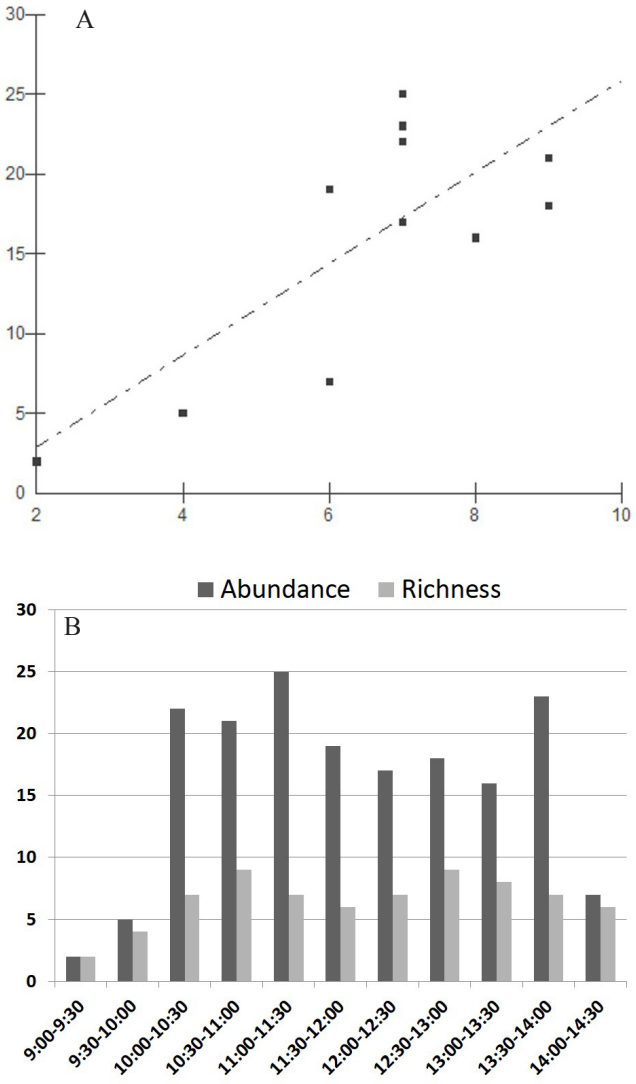

Fig 1. Relationship between abundance and richness (A), and variations in abundance and richness (B) throughout the day.

Table 1: Frequency of social wasps, arrival behavior, aggressiveness, and dominance while foraging on fruits of *Mangifera indica* L. (AB - aggressive behavior, NA - did not exhibited aggressiveness).

Species	Abundance	Arrival behavior of wasps on fruits				Dominance	Agressiveness
		I	II	III	IV		
Agelaia vicina	3			X		0.017	NA
Polybia bifasciata	8	X				0.045	NA
Polybia ignobilis	28	X				0.160	AB
Polybia jurinei	18	X			X	0.102	NA
Polybia sp	8	X				0.045	AB
Polybia platycephala	62	X	X			0.354	NA
Polybia scutellaris	1	X				0.005	NA
Polybia fastidiosuscula	15		X			0.085	NA
Synoeca cyanea	3	X				0.017	NA
Mischocyttarus araujo	3		X			0.017	NA
Mischocyttarus cassununga	22			X		0.125	NA
Polistes versicolor	4	X				0.022	NA
Total	**175**						

platycephala Richards, 1951, *Polybia ignobilis* (Haliday, 1836), and *Mischocyttarus cassununga* (Von Ihering, 1903) presented the highest dominance indices (d = 0.354; d = 0.160, and d = 0.120, respectively) and *Polybia scutellaris* (Write, 1841) was recorded only once (Table 1).

All species exploited fruits with pre-existent orifices (mainly caused by other insects such as *Atta* ants and the bee *Trigona spinipes* Fabricius, 1973. The only exception was the species *Synoeca cyanea* (Fabricius, 1775), which was always observed breaking the skin of fruits. This behavior suggests that this species may become a pest in some environments due to its potential to damage fruits. The same behavior was observed by De Souza et al. (2010) in jabuticaba trees and by Brugger et al. (2011) in guava trees. However, Prezoto & Braga (2013) recorded that this behavior of *S. cyanea* in Spanish prune results from wasp predation on larvae of the fruit fly *Zaprionus indianus* Gupta, 1970, which qualifies this wasp as a natural enemy of this pest.

Most wasp species landed directly on the fruit (I). Only the species *Polybia jurinei* Saussure, 1854 and *P. platycephala* displayed more than one arrival behavior (Table I). The wasps *P. ignobilis* and *Polybia sp.* were the only species that displayed aggressive behavior (Table I). All the other species were recorded using the same fruit without displaying aggressive behavior (Table I).

Although the species *P. ignobilis* and *Polybia sp*. represent only 20% (n = 36) of the wasps recorded in the study, the aggressive potential of these species should be taken into account to avoid accidents, since they are swarming species, whose colony population easily surpass hundreds of individuals. We also emphasize that *P. ignobilis* was also described by Hermes & Kohler (2004) as an aggressive species.

Based on our results, we suggest that in the period from 10:00 to 14:00, characterized as the activity peak of wasps on fruits, the collectors have an extra care during their activities, as for example the use of personal protective equipment, or even the interruption of the collection activity to reduce the risk of accidents by stings.

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