

## Effect of agrochemicals on the pattern of visitation of honey bees (*Apis mellifera*) in melon (*Cucumis melo*) flowers in Brazilian Northeast

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### Abstract

**Background:** Lately pollinators of the main crops have presented a decline with considerable economic impacts. Among the probable causes of this problem is the inadequate use of pesticides, mainly in monocultures. The culture of melon (*Cucumis melo*) is dependent on pollination services by honey bees (*Apis mellifera* L.). However, agrochemicals are not applied with special care to the visitation of bees in cultivated areas at the irrigation pole of Petrolina-Juazeiro, located in Brazilian Northeast. Therefore, the objective of this study was to evaluate the effect of agrochemicals pulverization on the pattern of visitation of honeybees to melon flowers.

**Results:** In the dry season the honey bees' visits occurred since 6 a.m. in larger numbers than in the wet season. Indeed, in the dry season, there was a negative effect of the application of agrochemicals on the frequency of visitation by *A. mellifera*, after the 1<sup>st</sup>, 2<sup>nd</sup>, and 5<sup>th</sup> day of pulverization. This effect was more intense on the 1st day, when there were registered average values smaller than one visit, independently of the flower type and time of the day. Moreover, the first visits were observed only from 8 a.m. On the 5<sup>th</sup> day the average numbers of visits were still lower than in the dry season, but higher than on the previous days.

**Conclusion:** Comparing both seasons, we found that the frequency of visitation observed in wet season was lower than that found in dry season. This indicates that the productivity of the melon in the first period can be reduced by the excessive application of agrochemicals, since there will be a reduction of the pollination services.

**Keywords:** melon, pollination, agrochemicals, honey bees, *Apis mellifera*

### 1. Introduction

Pollinators of the main crops apparently are in decline with considerable economic impacts. The inadequate use of pesticides, mainly on the monocultures, is one of the probable causes of this problem. Apart of the lethal effect, easily perceived, the impact of pesticides on pollinators, especially bees, can cause more subtle alterations on their behavior. These changes may culminate with the rupture of the division of labor and the social exclusion of the contaminated bees, and eventually cause serious problems for the colony<sup>1,2</sup>.

The role of pollinators as promoters of agricultural production is undeniable. However, the current production systems, inputs and agricultural practices have caused negative effects on these agents, both on their diversity and abundance and on pollination efficiency<sup>1</sup>.

The melon (*Cucumis melo* L. – Cucurbitaceae) crop is dependent on pollination services carried out by *Apis mellifera* L. Simultaneously, many pesticides are used to control plagues and diseases mainly during the wet season, when pests are more frequent. Nevertheless, the consequences of agrochemicals application on the pattern of visitation of bees, and its relation with the fruit production is unknown. Thus, this study aimed at quantifying and comparing the visitation pattern of *A. mellifera*, in two periods of the year, the dry season without the use of agrochemicals, and the wet season with the application of agrochemicals.

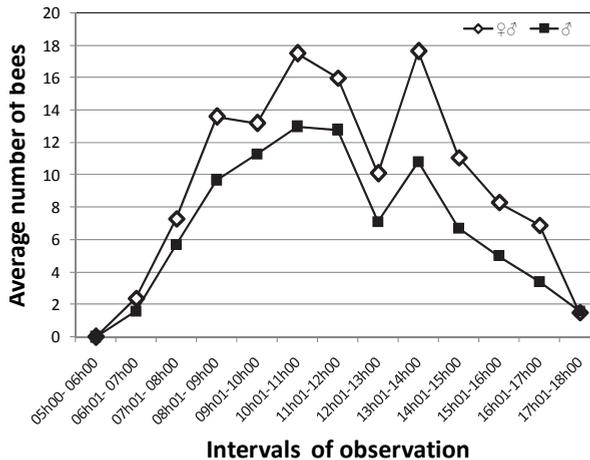
## 2. Material and methods

The work was performed in a commercial area at the irrigated perimeter of Mandacaru, in Juazeiro (09°24'S, 40°26'W), Bahia, in Brazilian Northeast. For the observations seeds of melon (yellow kind, 10/00) were used. The seeds were cultivated in a conventional system with mulching, drop irrigation, without the introduction of honey bee hives.

In order to register the flower visitors, daily and simultaneous observations were done on the two kinds of flowers (hermaphrodite and male) in two periods of the year. The timetables for the agrochemicals applications were different, depending on the climatic and plant phytosanitary conditions. In the dry season (July 2010) 10 flowers were observed (n= 5 ♂ and n=5 ♀), and in the wet season (March 2011), 32 flowers (n= 16 ♂ and n=16 ♀). The frequency and behavior of the flower visitors were observed from 5 a.m. to 6 p.m., and the average numbers of visitors were calculated per time and per floral type.

## 3. Results and discussion

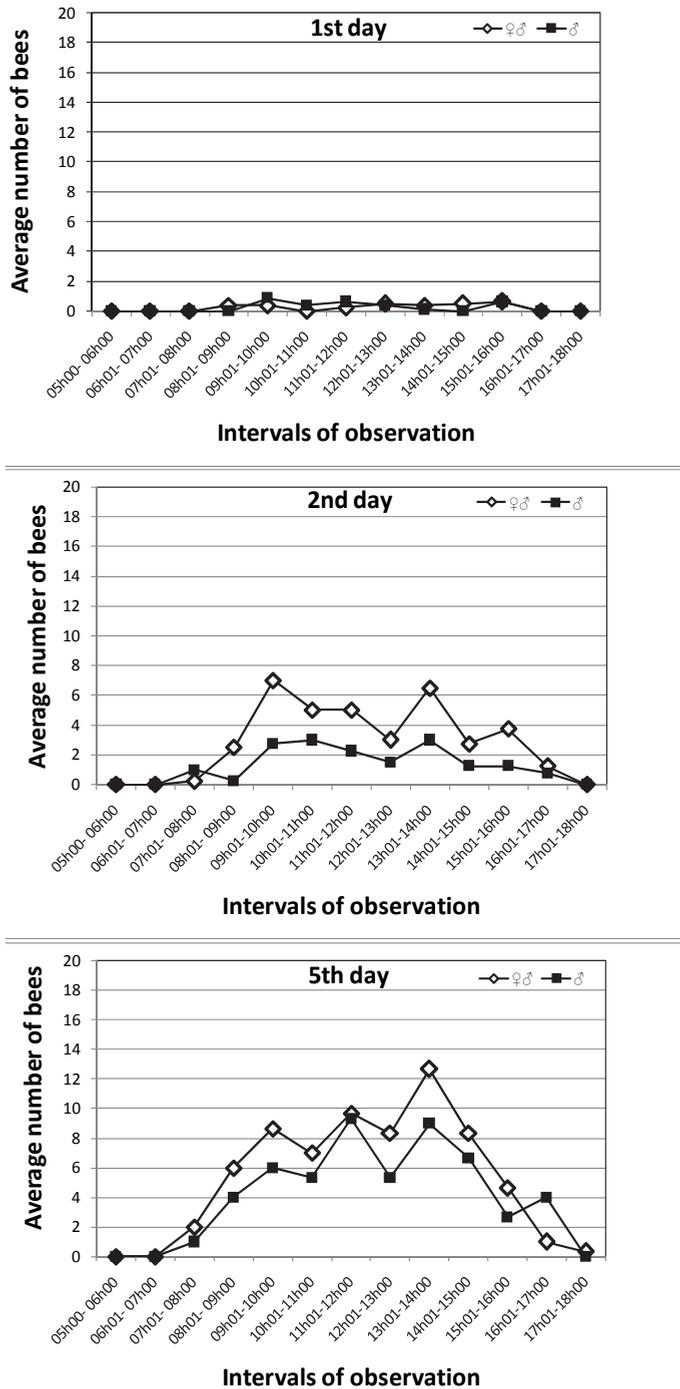
In the dry season it was verified that the visits of *A. mellifera* occurred from 6 a.m. in both kinds of flowers. For hermaphrodite flowers, the average number of visits of *A. mellifera* varied from 1.5 visits (recorded from 5 p.m. and 6 p.m.), to 17.5 visits (observed from 10 a.m. to 11 a.m., and from 1 p.m. to 2 p.m.). For male flowers, this number varied from 1.6 visits, which was recorded early in the morning (from 6 a.m. to 7 a.m.), and in late afternoon (from 5 a.m. to 6 p.m.), to 12.8 visits (from 11 a.m. to 12 a.m., Figure 1). In general, in all intervals, hermaphrodite flowers were more visited than male flowers. These results are in agreement with a work<sup>4</sup> carried out previously with the same melon variety in an experimental area.



**Fig. 1** Average number of honeybees visiting melon flowers (hermaphrodite: ♀♂ and male: ♂) in the dry season, in Juazeiro.

In the wet season (Figure 2), in general, it was verified that the average number of visits of *A. mellifera* for each interval of observation was much smaller than the average observed in the dry season. This result may be related to several factors. One could be the flowering of the surrounding vegetation which would compete for the visitors' attraction but, at least close by, flowers were not observed during the experimental period. The other aspect could be the negative effects of the agrochemicals, since these are used more frequently (daily) and in greater quantities during the wet season, due to a higher incidence of pests and plant diseases. Comparing the frequency of visits at the 1<sup>st</sup>, 2<sup>nd</sup> and 5<sup>th</sup> day, after pulverization, it was observed that the effect of the agrochemicals application was higher at

the first day, when average values below one visit were recorded, regardless the floral type and time. Moreover, the first visits were observed only from 8 a.m. (Figure 2).



**Fig. 2** Average number of honeybees visiting melon flowers (hermaphrodite: ♀♂ and male: ♂) in the wet season, on the 1<sup>st</sup>, 2<sup>nd</sup>, and 5<sup>th</sup> day after pulverization, in Juazeiro.

On the second day, the visits were recorded from 7 a.m. when the frequency of visits varied from 0.25 to 7.0 for hermaphrodite flowers, and from 0.25 to 3.0 for male flowers. On the fifth day there was no difference between the time of the first visits, however the frequencies were higher for both hermaphrodite (1.00 to 12.67) and male (1.00 to 9.33) flowers. According to other studies<sup>3</sup>, for the development of fruits with commercial characteristics, 10 to 15 bee visits are necessary. This number of visits was registered only on the fifth day, which indicates that during all this period the fruits that were developing probably did not fulfill the commercial standard parameters. As the production of hermaphrodite flowers occurs during a short period of the culture cycle<sup>4</sup>, the indiscriminate use of agrochemicals in this period may compromise fruits' production.

#### 4. Conclusion

Comparing both periods, it was found that the frequency of visits recorded in wet season was lower than that recorded in dry season. This indicates that the melon productivity during the wet season can be affected by the excessive application of agrochemicals, due to a consequent decrease of the pollination services.

#### Acknowledgments

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