

# POLLEN COLLECTION AND INFESTATION BY THE MITE *Varroa jacobsoni* IN COLONIES OF *Apis mellifera* L. (HYMENOPTERA, APIDAE).

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**ABSTRACT:** During 12 months, the pollen collection activity and the amount of pollen carried by worker daughters of africanized queens and worker daughters of Italian queens were observed. In both evaluations no significant differences between the analysed bees was perceived. The infestation rates of the mite *Varroa jacobsoni* on adult bees and on pupae combs of Africanized and Italian bees were low and no significant difference was observed between the infestation rates of the analyzed bees.

**KEY-WORDS:** bee, *Apis mellifera*, pollen, *Varroa jacobsoni*, Africanized bee, Italian bee.

## INTRODUCTION

The introduction of africanized bees (*Apis mellifera scutellata*) in Brazil in the late 1950's, with the consequent swarming of some beehives, resulted in desorganized and large scale crossing with the European honey bees already present in the country. Such crossings can be classified as one of the most fascinating and non-intentional experiments made in biology (RUTTNER, 1986).

Some studies compare Africanized and Italian bees according to the production of honey, wax, propolis, royal jelly and activities related to pollinization and also to the development of the beehives, but the results of these experiments are very variable. Africanized bee workers differ individually from the Italian ones for instance by their weight (OTIS, WINSTON & TAYLOR, 1981; OTIS, 1982; WINSTON, TAYLOR & OTIS, 1983) and egg, larval and pupal duration (HARBO *et al.*, 1981). According to pollen collection, comparative studies between Africanized and Italian honey bees showed that the former collect more pollen (NEVES & STORT, 1980). This difference results in some important characteristics of differentiated development between these two bees (WINSTON, 1992).

Pollen collection is one of the most important behaviors inside a beehive, because it is the main source of proteins, vitamins, fat and minerals for the bees (HELLMICH II, KULINCEVIC & ROTHENBUHLER, 1985). Colonies with a low amount of pollen will have serious

problems with brood production (MORITZ, 1994).

In general, parasites have a great influence on the development of their hosts. In the case of bees, the parasite mite *Varroa jacobsoni* of *Apis mellifera* and *Apis cerana*, is not different, since it is the pest that most affects world-wide apiculture nowadays (MORETTO & GONÇALVES, 1992).

Since the introduction of the mite in our country 15 years ago, the infestation has remained low (2 to 3%) (GONÇALVES, 1986). The reduced infestation rate depends not only upon the climate, but also upon specific characteristics of each bee, probably because the africanized bees have already acquired some resistance against *Varroa jacobsoni* (ENGELS *et al.*, 1986).

The objective of this work was to evaluate comparatively, the amount of pollen collected by africanized workers and workers descendant from Italian queens, and also, the infestation rate by the mite *V. jacobsoni* on beehives with Africanized queens and with Italian ones.

## MATERIAL AND METHODS

Sixteen Langstroth nests were used, eight of which, contained Italian queens originally from Queen's - Way Apiaries - Bloomington Indiana - (USA); and eight contained africanized queens, obtained from combs maintained by the apiary of the Instituto de Biociências, Rio Claro (UNESP). Queens performed natural mating in the region of Rio Claro (SP).

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Weekly, throughout 12 months, two beehives were chosen among the sixteen, where one was descendant from an Africanized queen and the other from an Italian queen. These beehives were previously prepared by counting the bees, closing their entrance and leaving only one opening (10 cm).

The beehives were observed twice a day, in the morning and in the afternoon. These observations were done at 10 minute intervals, where the bees carrying pollen were counted. The time chosen to evaluate the collection was based on data of flight activity reported by KERR *et al.* (1970), that is, around 8:30 a.m and 4:30 p.m. After counting the collectors of each beehive, 20 bees carrying pollen were captured and singly maintained in small vials. These bees were anesthetized with carbon dioxide, so that the pollen could be taken off and weighed afterwards.

Results were submitted to the T-test (Student) and to the independent G - test, by considering the number of workers that entered the beehive with pollen (SOKAL & ROHLF, 1981). The infestation rate by the mite on broods and adult honey bees, was determined six times, from March/87 to February/88, in three beehives of Africanized bees and in three Italian ones. The beehives were drafted at each experiment and, the period was chosen depending on the beehives' conditions. The months in which experiments were performed were: February, March, April, July, September and December.

To determine the infestation rate on broods, 50 cells from each side of a comb from the central region of the beehive, containing pupae of workers with dark eyes and body in the beginning of pigmentation, were observed. The infestation rate was obtained through the proportion between the number of analysed cells. Infested and non-infested pupae by the mite were weighed in an analytic balance.

From the same selected beehives, samples of adult workers from a central board were collected. Each sample, containing 500 adult bees, was put in a vial with 250 ml of 70% alcohol. At least 4 hours after the collection, samples were transferred to a one-liter plastic bottle, cut in the middle, internally containing a wire screen (mesh 0.5 mm) next to the neck of the bottle, allowing, this way, to separate mites from bees, through a mechanic agitator (STORT *et al.*, 1981).

After determining the number of mites and bees per sample, the infestation rate on adult bees was computed through the proportion of number of mites and the total number of sampled bees, multiplying each obtained value by 100. Results were submitted to the test of proportions and the weight of infested and non-

infested pupae was analysed by the T-test (student) (SOKAL & ROHLF, 1981).

## RESULTS AND DISCUSSION

The results of pollen collection activity by Africanized bees and Italian ones, allow us to tell that in a yearly average, there was no significant difference between the two kinds of bees. The number of workers that entered with pollen into the beehive, during the morning period was: Africanized  $98.18 \pm 71.17$  X Italian  $77.04 \pm 48.92$ ;  $p = 0.406$ ,  $t = 0.848$ ; and in the afternoon was: Africanized  $54.33 \pm 24.36$  X Italian  $69.76 \pm 51.72$ ;  $p = 0.360$ ,  $t = 0.935$ .

Besides the number of pollen collectors, daughters of Africanized queens and Italian ones, did not differ statistically throughout the year; when the data was organized monthly in a graphic (Fig. 1), it can be noted that the performance of worker daughters of africanized queens is better from spring until the end of summer in the morning. In the afternoon, worker daughters of Italian queens have a better performance from the end of winter until the middle of spring.

Results registered according to the number of pollen collectors do not agree with data observed by DANKA *et al.* (1987) and PESANTE *et al.* (1987), since these authors noted a greater performance of Africanized bees in relation to the Italian ones.

According to the results of the G-test in the two periods when pollen collection was observed, it can be said that the number of pollen collectors depends basically upon the kind of bee, week and month considered, needing to be related to the amount of available pollen in the region, changes in the climate and needs of the beehive. PESANTE, RINDERER & COLLINS (1987) observed similar results comparing the same kinds of bees in Venezuela.

As to the average amount of collected pollen per bee, it was noticed that there was no significant difference between the two kinds of bees in the observed periods, in the morning Africanized honeybees carry an average of  $8.76 \pm 1.52$  mg of pollen by trip while worker daughters of Italian queens carry  $9.03 \pm 2.86$  mg ( $p = 0.789$ ;  $t = 0.277$ ); in the afternoon, africanized workers transport  $8.42 \pm 2.95$  mg of pollen, while daughters of Italian queens carry  $7.52 \pm 1.93$  mg ( $p = 0.408$ ;  $t = 0.845$ ).

There are several works in the literature specifying on revealing how much pollen an Africanized and an Italian worker transport to a beehive. FUNARI (1985) observed that Africanized workers in the region of Botucatu (SP) transport an average of 11.37 mg of pollen by trip; COUTO (1987) registered in the region of

Jaboticabal (SP) the amount of 6.54 mg and TANDA (1985) estimated for the Italian honeybee 9.10 mg and MORSE & HOOPER (1985) 15.50 mg.

MALASPINA, STORT & CHAUD-NETTO (1993) studying the pollen collection by the Africanized bees, *Apis mellifera caucasica* and those descendant from breeding among the two, observed that, on average, the africanized ones transport 7.29 mg, while the caucasian ones 5.91 mg.

Differences observed in the average amount of pollen that each bee transports to the beehive, according to the results of MALASPINA, STORT & CHAUD-NETTO (1993) and can be partially applied to the disponibility of flowers in the considered region, the orientation of the bees on the flower sources and also to factors of genetic origins (HELLMICH II, KULINCEVIC & ROTHENBUHLER, 1985).

Presumably, the observed results in relation to transport and pollen collection are related to evolutive processes which africanized bee populations went through. That is, according to studies of isoenzymatic systems it was observed that in the South and Southeast of Brazil, africanized bees have a greater European component (27% of European component associated to 73% of the African component) than in the Northeast (14,5% of European component associated to 85,5% of African component) (DINIZ-FILHO & MALASPINA, 1995a). The same characteristics of "africanization" were also observed by DINIZ-FILHO & MALASPINA (1995b) based upon morphometric data of Africanized bee wings all over Brazil.

During the months that the infestation the rates of mite *Varroa jacobsoni* were observed, it could be noticed that in the case of the Africanized workers, 2.89 cells were infested, while in the Italian ones, there were 7.67 cells infested with the parasite, on average. Considering the adult workers, from one hundred analysed bees, 2.40 were infested by the mite in the case of Africanized workers and 3.61 among Italian workers. Through the porportion equality test for the general mean, the results of which were  $Z = -1.51$  for the infestation rate or pupa cells and  $Z = 0.50$  for the infestation rate on adult bees, it was verified that there was no significative difference, at the level of 5% between the worker daughters of Africanized queens and worker daughters Italian ones.

According to the infestation rate on cells of pupae, the results obtained reinforce CAMAZINE's (1986) observations. Using the same test, considering the results of each month, difference was only noticed in the months of March ( $Z = 2,32$ ) and September ( $Z = 2,99$ ) for the

infestation of pupae cells. In these months, workers descendant from Italian queens suffered a greater infestation. Anyway, the observed rates are low agreeing with GONÇALVES's (1986) work.

GUERRA & GONÇALVES (1992), estimating the level of infestation of *V. jacobsoni* on adult bees and the invasion rate of this parasite on broods, between July 1990 and December 1991 in the region of Ribeirão Preto (SP) verified that the Italian colonies are more susceptible to infestations. The results obtained by these researchers are very similar to ones recorded in this work, except for the infestation on Italian broods, that was greater in our research. The presented results agree with the observations of ENGELS *et al.* (1986), according to racial differences found in the infestation rate of the mite.

MORETTO & GONÇALVES (1992) tried to verify if among pure Italian *Apis mellifera* bees and africanized ones there is a mechanism that allows workers to became free from the mite *V. jacobsoni*, when they are experimentally infested with adult females of this parasite. They found that 38.9% of the infested africanized workers became free, while only 5.4% of the Italian queens showed the same behaviour.

Pupae, daughters of Africanized and Italian queens infested and non-infested by the mite *V. jacobsoni*, were weighed and the results were statistically analysed by the T- test. Results showed that there is a significative difference ( $p = 0.00$ ;  $t = 4.092$ ) between pupae daughters of infested Africanized queens ( $100.56 \pm 6.32$  mg) or not infested ( $105.03 \pm 5.62$  mg), and between pupae daughters of Italian queens ( $p = 0.01$ ;  $t = 2.614$ ) infested ( $103.80 \pm 9.46$  mg) or not infested ( $107.32 \pm 9.61$  mg). When a comparison is made only between infested pupae of the two racial types there is no significative difference ( $p = 0.541$ ;  $t = 0.617$ ) between daughters of Africanized queens ( $100.93 \pm 6.24$  mg) and Italian ones ( $102.33 \pm 7.89$  mg).

Although significative differences have been observed between the weights of pupae infested or not, it can be said in general, that the development of the beehives were not affected since infestation rates of the mite *V. jacobsoni* were very low. Such affirmation can be complemented by the work of MESSAGE (1986), who sffirms infestation rates by the mite, besides damaging individually the parasitized bees, do not seem to directly affect the beehive as a whole.

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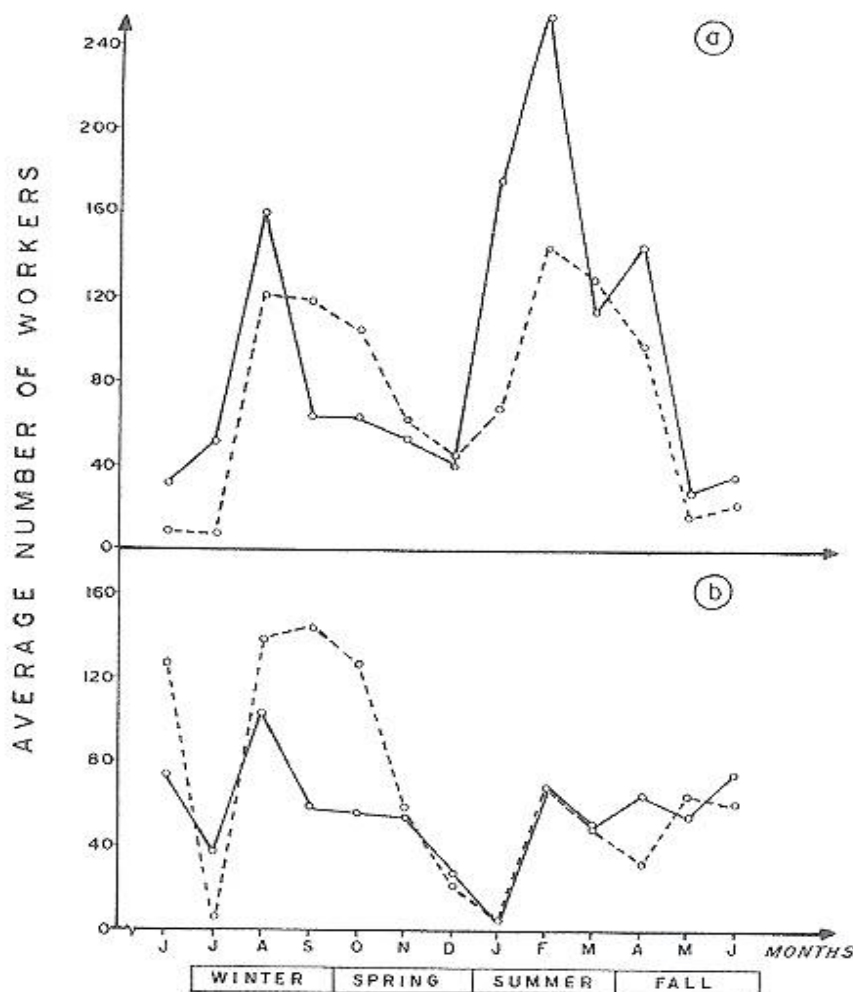


Figure 1. Monthly average number of Africanized (—) and Italian (-----) workers that entered with pollen in the beehive, during 10 minutes, in the morning (a) and in the afternoon (b). (1987/1888)

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