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INFESTATION AND DISTRIBUTION OF THE MITE Varroa jacobsoni
IN AFRICANIZED HONEY BEE (Apis mellifera) COLONIES

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SUMMARY

Whereas in several parts of the world varroa is the major pest affecting apiculture, in others the parasite is unknown to many beekeepers because of the little damage it causes to bees. The impact of the mite Varroa jacobsoni is related to the climatic conditions and the races of Apis mellifera bees in each region where the pest exists. In the present study, the mite infestation levels were assessed to determine the evolution of the pest in Africanized bee colonies in Southern Brazil. The current level of infestation was considered low, approximately two mites per one hundred adult bees. This result is similar to that obtained for the same apiary almost five years ago and for others distributed in various regions of Brazil. In the present study, on average, 61% of the total varroa population was found in the worker brood.

RESUMEN

En diversas regiones del mundo, varroa es considerada como la plaga que más daños causa a la apicultura. Sin embargo, en otras regiones el parásito es desconocido por los apicultores, ya que causa pocos daños a las abejas. El impacto del ácaro Varroa jacobsoni en cada región está relacionado con las condiciones climáticas y con la raza de abejas Apis mellifera. En el presente estudio se evaluó la evolución de la varroatosis y la distribución del ácaro V. jacobsoni en colonias africanizadas en el sur de Brasil. El nivel de infestación del ácaro V. jacobsoni en las colonias de abejas africanizadas fue de aproximadamente dos ácaros para cada cien abejas adultas. Esta infestación es similar a la observada en el mismo apiario durante años anteriores. Entre la población total de ácaros 61% fue encontrada en las crias de obreras.

RESUMO

Enquanto em diversas parte do mundo a varroa é considerada a mais preocupante peste que afeta a apicultura, em outras o parasita torna-se desconhecido por muitos apicultores devido aos poucos danos causados nas abelhas. O impacto do ácaro Varroa jacobsoni está relacionado às condições climáticas e a raça de abelhas Apis mellifera em cada região onde a praga se estabeleceu. No presente estudo foi avaliado a evolução da varroatose e a distribuição do ácaro Varroa jacobsoni em colônias de abelhas africanizadas no sul do Brasil. O grau de infestação alcançado pela praga varroatose nas colônias de abelhas envolvidas nesse trabalho foi de aproximadamente dois ácaros para cada cem abelhas adultas. Esta infestação é semelhante a encontrada no mesmo apiário no ano de 1995. Da população total do ácaro 61% foi encontrado nas células de crias de operárias.

Introduction

The mite Varroa jacobsoni, an ectoparasite of brood and adults of Apis cerana and Apis mellifera, was limited to some regions of the world while it was parasitizing only the species A. cerana, the original host, without causing damage to apiculture. The parasite-host relationship between A. cerana and varroa seems to have reached equilibrium because of the development of defense mechanisms by this bee species against the parasite (Peng et al., 1987).

The contact of varroa with A. mellifera, which possibly occurred at the end of the fifties, was characterized by rapid dispersal of the pest. Today the parasite infests bee colonies in many countries in Europe, Africa, Asia and America. Apiculture started to feel a strong impact due to the drastic effects of varroosis in various regions of the world in the 1970s, with high rates of brood and adult bee infestation in colonies of A. mellifera (De Jong, 1984).

To minimize the effects of varroa infestation on A. mellifera, several acaricides have been developed. However, thus far no chemical product has proved to be fully effective in terms of eradicating the pest. On the contrary, cases of development of resistance to certain acaricides by V. jacobsoni have been observed (Boot et al., 1995).

The effects of varroa infestation on A. mellifera manifest themselves with different intensity in the various regions of the world where the...
parasite has become established. In general, bees of African races and their hybrids show more tolerance to *V. jacobsoni*, with no serious losses for apiculture (De Jong *et al*., 1984; Montiel and Piola, 1976). The reproductive process of *V. jacobsoni* starts when the adult female parasite abandons an adult worker bee or drone and penetrates worker or drone brood cells (Gusman-Novoa *et al*., 1999).

The female invades cells of worker and drone brood of *A. cerana* and *A. mellifera* when the bee brood reaches the last larval stage, few hours before the cell is sealed (De Jong, 1997). Thus, when honey bee colonies have brood and adults, the varroa population is distributed among them.

The objective of the present study was to evaluate the infestation level of varroasis at different times and the distribution of the varroa population in colonies of Africanized bees.

**Materials and Methods**

The study was conducted on eight nuclei (nucleus colonies containing four standard langstroth size brood combs) of Africanized bees from the experimental apiary of the Department of Blumenau, State of Santa Catarina, Brazil, at 26°55'10" S and 17°m latitude.

To evaluate the distribution of varroas on brood cells and adult bees in each bee colony, the quantity of brood and adult bees was first estimated.

**Estimate of adult bee population**

To estimate the population of adult bees, each bee colony was weighed twice. The first weighing was performed during the day and consisted of weighing each hive with no adult bees inside. During the night of the same day when the material was weighed, each colony was weighed when containing the adult bees and all the material. The difference in weight between the two determinations provided the net weight of the adult bees in the colony.

Five samples of 100 adult bees from each colony were weighed on a Master scale with 0.5 mg precision. Using the mean weight of five samples and the weight of adult bees in each colony, the population of adult bees was estimated using the expression

\[ y = a/bc \]

where: 
- \( y \): population of adult bees
- \( a \): 100 adult bees
- \( b \): weight of the population of adult bees
- \( c \): mean weight of 100 adult bees

**Estimate of the quantity of capped brood**

The combs containing capped brood in the last larval stage were measured using a support comb with a 1 cm² mesh wire grid. The number of cells with brood was counted in 20 areas of each colony to determine the total number of cells with brood. The total number of cells in each colony was estimated by multiplying the number of colony areas with brood by the mean number of cells per area.

**Estimate of the number of varroa mites on adult bees**

Five samples of 200 to 300 adult bees were collected on alternate days from each hive. The method of De Jong *et al.* (1982) was used to estimate the number of mites per adult bee. The population of varroas on the adult bees was obtained by multiplying the mean number of mites occurring in the five samples by the total number of adult bees.

**Estimate of the number of varroa mites in the brood**

Five hundred cells per bee colony were uncapped and the number of varroas was counted. The total number of mites was estimated using the expression

\[ x = a/b/c \]

where: 
- \( x \): number of varroas on the brood
- \( a \): total number of cells with brood
- \( b \): number of varroas in the 500 cells analyzed
- \( c \): 500 cells analyzed

The total number of varroas in each bee colony was obtained from the sum of the number of varroas estimated on brood and adult bees.

**Results and Discussion**

The mite *V. jacobsoni* has been infesting Africanized bees in Brazil for almost 30 years. Soon after its discovery, although there were no reports of the death of bee colonies, the levels of infestations detected were a source of concern for Brazilian apiculture. However, as the parasite started to disperse through the country, the infestation levels in Africanized honey bees was found to be low, causing no apparent damage to our apiculture and requiring no use of chemical products to control the pest (Gonçalves, 1987).

The climatic conditions of Brazil, taken together with various mechanisms present in Africanized bees, render these bees tolerant to the mite *V. jacobsoni* (Camazine, 1986; Moretto *et al*., 1993; De Jong and Soares, 1997).

The degree of infestation estimated in the present study was 2.33 ±0.83% (mean and standard deviation) in adult bees and 5.06 ±2.47% in worker brood.

The honey bee colonies studied here are part of an experimental apiary set up in 1992. Some of these colonies were collected from natural swarms while others were the result of the process of artificial colony division. The average mite infestation levels in honey bee colonies of these apiary was 1.78% in 1995 (Moretto *et al*., 1995). Thus, almost five years later, the varroa infestation levels in this apiary continues unchanged, with a low degree.

The total varroa population (estimated number of varroas on adult bees and brood) in these honey bee colonies was on average 724 ±419 mites per colony. Although the present study was conducted on hives of the nucleus type (four combs), and therefore with a limited number of adult bees and brood, and a limited brood area, the varroa population can be considered low for the period of time during which these bee colonies have been infested with the parasite, with no treatment for pest control.

It is known that to complete their reproductive cycle, adult varroa females abandon adult bees and invade worker and drone brood cells. Of the total varroa population in the colonies studied here, 61% were found, on average, in the worker brood.

Although thus far there is no mechanism that will explain why the varroa mite leaves an adult bee to invade brood cells, it is known that the number of varroas on brood is related to the season of the year and to the availability of brood in the hive (Boutilier *et al*., 1994a, Eguarás *et al*., 1994). However, according to Boutilier *et al.* (1994b), the mite enters a brood cell immediately after abandoning the body of an adult bee. Varroas were never observed walking on the comb, showing that the mite does not look for the specific brood cell it invades.

The number of descendants that varroa females can leave on Africanized bees is smaller than that found in bees of European honey bee races (Medina and Martín, 1999). It is also known that Brazilian Africanized bees, when artificially parasitized with adult varroa females, can rid themselves of the parasite by performing vigorous body movements, called grooming (Moretto *et al*., 1999). This behavior of Africanized bees is also observed under natural conditions, i.e., it is possible.
to see workers performing body movements when they are infested with varroas. According to Boot et al. (1995), the Africanized bees of Brazil, A. cerana in Asia and A. m. intermissa in Africa present the grooming behavior and have a large number of varroa females that do not leave descendants when they parasitize cells with worker brood.

The high percentage of mites on worker brood of Africanized bees detected in the present study may also be associated with the grooming behavior of these bees, causing the varroa to look for brood as a means of protection against the attack of workers, instead of leaving adult bees to invade the brood to perform its reproductive cycle. This may be one of the causes of the small number of descendants left by V. jacobsoni on Africanized bees. However, new studies should be conducted to determine the distribution of the mite V. jacobsoni in A. mellifera colonies of European races.

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REFERENCES


