

THE EFFECT OF CLIMATE AND HONEYBEE RACIAL TYPE ON THE REPRODUCTIVE ABILITY OF THE MITE *VARROA JACOBSONI*

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Introduction

Since it established contact with *Apis mellifera* honeybees, the mite *Varroa jacobsoni* has presented different population dynamics in the various regions of the world, where varroasis has established itself as a pest. Under temperate climatic conditions, varroa has found perfect conditions for development and has become a pest causing severe damage to apiculture, whereas under tropical and subtropical climatic conditions the mite has reached low levels of infestation that have not caused any apparent damage to honeybee colonies (DE JONG et al., 1984; RITTER and DE JONG, 1984; ENGELS et al, 1986).

The reproductive cycle of varroa starts when adult female parasites abandon adult workers and drones and invade the brood cells of workers or drones to perform oviposition (RUTTNER and RITTER, 1980; IFANTIDIS, 1988).

The reproductive ability of *Varroa jacobsoni* females in worker brood cells has an important effect on the development of the pest and

is affected by climate conditions and by the bee race. RITTER (1988) reported that 76% of the varroa females are able to leave descendants. RUTTNER et al. (1984), working with European bee hybrids under the climatic conditions of Uruguay, obtained 70 to 90% unfertile varroa females.

ENGELS et. al. (1986), in a study carried out under the climatic conditions of Ribeirão Preto, State of São Paulo, Brazil, noted that the reproductive ability of varroas that parasitize *Apis mellifera carnica* cells is lower than that of varroas that parasitize cells of the same honeybee race under the climatic conditions of Europe. Under the climatic conditions of Poland, Muszynska and Konopacka (1989) noted that the reproductive ability of varroa females varies with the season of the year and from year to year.

In bees of European races, the rate of varroa reproduction is higher compared to bees of African races (RITTER and DE JONG, 1984; SCHULZ, 1984; CAMAZINE, 1986; ENGELS et al., 1986; MENDOZA et al., 1987; OTTEN, 1989; MORETTO et al., 1991).

In a study on Africanized and European bees, carried out in Ribeirão Preto, ROSENKRANZ (1990) noted that 50.30% of the adult *Varroa jacobsoni* females that parasitized brood cells of Africanized worker bees did not leave any type of descendants, whereas 15.90% of the varroas that parasitized the same type of cells of European bees did not leave any descendants.

The reproductive rate of fertile varroa females that invade the worker brood cells was also found to be affected by the bee race. The values obtained for *Apis mellifera carnica* were much higher than those obtained for Africanized bees in Brazil (MESSAGE, 1986; ROSENKRANZ, 1990).

ROPSTORF (1989), in a study on the reproductive rate of fertile females parasitizing the worker brood cells of African bees *Apis mellifera lamarkii* and of European bees *Apis mellifera carnica*, noted that the reproductive rate of the mite was almost twice higher in the European bees than in the African bees.

It is known that the only varroa descendants that have a chance to survive are those that reach the adult stage before the bee emerges. MORITZ and HÄNEL (1984) observed that varroa females cannot leave viable descendants in brood cells of *Apis mellifera capensis* worker bees which brood development is 2.4 days shorter than that detected in *Apis mellifera carnica*. Thus, the difference in development between European and African *Apis mellifera* races must be a

factor that strongly influences the reproduction of *Varroa jacobsoni*. BUCHLER and DRESCHER (1990) reported that a one hour reduction in the post-capping period determined an 8.7% reduction in the infestation of the European bee worker brood.

The objective of the present study was to determine the effect of different climatic regions and of the *Apis mellifera* race on the reproductive rate of *Varroa jacobsoni* females parasitizing the worker brood.

Materials and Methods

The study was conducted in two different climatic regions, classified according to KOPPEN (1948), by ANDRADE (1964): Ribeirão Preto, State of São Paulo, 620 m altitude, 21°11'25" latitude South, with a mean annual temperature of approximately 21°C and a humid tropical climate with a hot and rainy summer and a mild and dry winter, São Joaquim, State of Santa Catarina, 1360 m altitude, 28°17'19" latitude South, with a mean annual temperature of 13°C and climate of the humid mesodermal type without a defined dry season. An experimental apiary containing two honeybee races was set up at each location. The apiary contained six colonies of Africanized bees with queens from swarms captured in the Ribeirão Preto region, and six colonies of hybrid Italian bees with queens originating

from mothers imported from the U.S. and Italy.

To evaluate the rate of varroa reproduction, data referring to the offspring of varroa females parasitizing worker brood in the dark-eyed pupal stage and with recently pigmented body (17—18 days old pupae) were collected monthly for two years. The number of adult varroas, eggs, protonymphs and deutonymphs was computed for each uncapped worker cell. Thus, we estimated the total reproduction of the parasite on the basis of the ratio between the number of any type of descendants (eggs, protonymphs and deutonymphs) and the number of adult varroas that invaded the worker brood cells. The ratio between the number of deutonymphs and the number of adult females is used to estimate the effective reproductive rate of the mite.

To evaluate the effect of the bee race and of the different climatic regions, we used the paired analysis of variance as a criterion for classification.

Results

When the total number of descendants (eggs, protonymphs and deutonymphs) left by each *Varroa jacobsoni* female invading the worker brood cells was considered according to the honeybee racial type in the two climatic regions, we obtained 1.36 and 1.72 descendants per adult female mite in Afri-

canized and in Italian bees, respectively. Statistical analysis showed that varroa presented a significantly higher total reproduction in Italian hybrid bees than in Africanized bees ($F = 9.59$; $P < 0.01$).

The mean number of total descendants obtained when considering the effect of the climatic region was of 1.51 and 1.57 descendants per varroa female in São Joaquim and Ribeirão Preto colonies, respectively. The difference between the two regions was not statistically significant ($F = 0.31$; $P > 0.05$).

As to the effective reproduction (number of deutonymphs) of the varroa females in the worker brood cells, the mean number of deutonymphs left on Africanized bees was of 0.58 and the mean number of deutonymph left on hybrid Italian bees was of 0.72 ($F = 12.95$; $P < 0.01$). When the effective reproductive rate in bees from the two climatic regions was considered, regardless of bee race, the number of deutonymphs in São Joaquim bees was of 0.66 per female and the number of deutonymphs in Ribeirão Preto bees was of 0.74 per adult varroa female. No significant difference was detected between the two regions studied ($F = 1.56$; $P > 0.05$).

Discussion and Conclusion

The *Apis mellifera* bee race parasitized by *Varroa jacobsoni* plays an important role in the development of the varroosis pest. Studies

carried out under the climatic conditions of Ribeirão Preto, State of São Paulo, show that the rate of varroa reproduction is higher in European bees than in Africanized bees (CAMAZINE, 1986; ROSENKRANZ, 1990). In the present study, we noted that the reproductive ability (total and effective reproduction rate) of this mite was higher in hybrid Italian bees than in Africanized bees in the two regions studied.

SCHULTZ (1984) obtained 1.82 deutonymphs per adult varroa female invading *Apis mellifera carnica* worker brood cells. In the present study, the highest effective reproduction rate was detected in hybrid Italian bees — 0.72 deutonymphs per varroa female — less than half the amount detected in *A. m. carnica* bees.

Under the temperate climate conditions of Europe, the reproductive rate of varroa in *Apis mellifera carnica* was higher than that detected in the same bee race under the climatic conditions of Ribeirão Preto (ENGELS et. al., 1986). Although the climatic conditions of the two regions studied here are quite different, the results related to the total and the effective reproduction of *Varroa jacobsoni* were identical for both regions.

Acknowledgements

We thank Roberto PRIES, apiculture technician of the Instituto de Apicultura de Estado de Santa Ca-

tarina for donating the bees used in São Joaquim apiary. We also thank João José dos Santos, apiculture technician in the Department of Genetics for his assistance in collecting data, maintaining colonies and producing queens in Ribeirão Preto Apiary. This work was funded by the Financiadora de Estudos e Projetos (FINEP), with some additional assistance from CNPq.

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