



Thesis Abstract

Reproduction of the mite *Varroa jacobsoni* in Africanized honey bee colonies in Brazil (Reprodução do ácaro *Varroa jacobsoni* em colônias de abelhas africanizadas (*Apis mellifera*) no Brasil)

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We studied the reproduction of the mite *Varroa jacobsoni* in 10 colonies of Africanized honey bees (*Apis mellifera* L.). The mean infestation rate of worker brood cells, evaluated monthly from September 1998 to September 1999, varied from 3.4 to 13.7% and was negatively correlated with the mean minimum temperature for the corresponding months. The mean infestation rate in adult bees was below 5%, varying from 1.5 to 4.4%. It was also negatively correlated with temperature (both minimum and maximum). We examined 16,844 worker brood cells, 1,216 cells of which (7.2%) were infested by varroa; 90.5% of these were infested by one original female mite, 8.7% by two and 0.7% by three. Among the cells infested by one adult female 77.7% had progeny, and among these the most common composition (32.9%) was five descendants, with a mean of 4.1 per female that reproduced. Among cells infested by two adult females, 89.6% had progeny, with a mean of 3.2 descendants per female. Reproduction was classified into three categories: 1) reproduction with viable offspring (RVO) - which includes a live male and at least one "viable" female (old enough to reach maturity and to be mated before the bee emerged); 2) reproduction with inviable offspring (RIO) - all of the progeny dead, or the male is dead and therefore any females cannot mate, or any live females are not old enough to reach maturity; 3) no reproduction (NR) - no descendants produced. Among the single original females, 40.5% had RVO, 37.2% RIO and 22.3% NR. The proportion of varroa with RIO varied significantly during the different months and was negatively correlated with minimum temperature and with relative humidity, but not with infestation rates, while the proportion of mites with RVO did not vary significantly among the study months. The proportion of NR mites was negatively correlated with the percentage of brood cells infested and positively associated with minimum temperature. Among the varroa with RVO, 55.2% produced two viable female

progeny. We calculated an ER (effective reproduction rate = number of viable daughters produced per original adult female) of 1.59 (when we included all females that had produced “viable” females), of 0.83 (when we included all females that had produced descendants), and 0.64 (when we included all of the original females). The TR (total reproductive rate = all progeny per original female) was 4.05 and 3.15, for females that produced any progeny and for all females, respectively. The TR for all females in cells with two or more original females was 3.08. Among the descendants, 34.1% were dead and 5.4% were inviable eggs. Mortality varied significantly among the study months. The mortality of the first descendant, the male, was 39.0%. This mortality varied from month to month, and was negatively correlated with relative humidity. The second and third descendants, the first and second daughters, had a mortality of 30.6 and 38.1%, respectively. An altered pattern of defecation was often found when the mites failed to reproduce. Normally there is an accumulation of feces on the cell wall. Among 68 NR females, 38 produced a fecal accumulation on the body of the bee (on the abdomen), three had feces spread over the body of the pupa, while the remaining 27 had the normal defecation pattern. Drone brood cells were also examined; among 1378 cells, 40.5% were infested with varroa. Almost half (45.9%) had one original varroa female and 27.2% had two. Less than 1% of the cells were infested with 6 to 9 varroa females. The most frequent type of reproduction (41.1%) in drone cells was six descendants per original female varroa. In cells infested by one adult female 84.2% produced a mean of 5.1 descendants. There were descendants in 99.2% of the cells infested by two adult females, with a mean of 4.6 descendants per original female. Cells with three and six original adults gave 3.8 and 3.0 descendants/female, respectively. In the infested drone cells, 52.6% of the varroa had RVO, 31.6% had RIO and 15.8% had NR. Among the varroa with RVO, 24.5% produced two viable daughters, 29.1% produced three and 32.7% produced four. The number of viable females (N= 329), in cells infested with one original female, gave an ER of 3.00 (329/110 - among all females that produced “viable” females), or 1.87 (329/176 - among all females that produced descendants) and 1.57 (329/209 - considering all original females). The corresponding TR figures were: 5.09 (896/176) and 4.29 (896/209) and in cells infested by one or more adult females it was 3.47 (3931/1133). Among the progeny produced, 72.0% were alive, 25.2% dead and 2.8% were inviable eggs. The male, the first descendent, had a mortality of 29.5%. The following descendants had mortalities of 13.3, 26.0, 22.8, 23.8 and 45.2%, respectively. The reproductive success of varroa was lower in Africanized than in European bees, which at least partially explains the lower infestations found in the former.