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Effect of weight of Africanized queens (*Apis mellifera* L.) at birth in honey production in semi-arid Piauiense

ABSTRACT

Objetivou-se verificar o peso de rainhas africanizadas ao emergir relacionando com a produção de mel no semi-árido piauiense. **A produção de rainhas foi realizada** no Setor de Apicultura da UFPI, nos meses de fevereiro-março e outubro-novembro de 2008, a **partir de colméia matriz selecionada em Bela Vista-PI. Para a produção de rainhas f**oram utilizadas três mini-recria. As rainhas após o nascimento, eram pesadas e selecionadas as com peso igual ou superior a 170 mg, sendo descartadas as demais. Com 13 dias da introdução, após a fecundação, as rainhas foram retiradas dos núcleos, pesadas e introduzidas nas colméias do apiário experimental de Bela Vista-PI. **O** peso médio das rainhas ao emergir e após à fecundação obtido no período chuvoso, foi de 201,71 mg $\pm$16,91 e 230,34 mg $\pm$17,62 respectivamente, superior ($P<0,05$) aos valores de 185,43 mg $\pm$8,84 e 209,34 mg $\pm$11,16, verificado no período seco, respectivamente. Houve relação significativa ($P<0,01$) do peso de rainha ao emergir com peso de rainha fecundada e este com produção de mel, e significativa ($P<0,05$) na relação entre peso de rainhas ao emergir com produção de mel, nos períodos chuvoso e seco. Rainhas produzidas no período chuvoso obtém maior peso ao emergir e após a fecundação e suas colônias apresentam maior relação com a produção de mel.

Palavras chaces: *Apis mellifera*, condições climáticas, peso de rainha fecundada, peso de rainha virgem, produção de mel

Effect of weight Africanized queens (Apis mellifera L.) at birth in honey production in semi-arid Piauí

RESUMO

Aimed to verify the weight of Africanized queens to emerge relating to the production of honey in the semi-arid Piauí. The production of queens was held in the beekeeping industry UFPI, in the months from February to March and October-November 2008, from honeycomb array selected in Bela Vista-PI. For the production of queens were used three mini-rearing. The queens after birth, were weighed and selected weighing less than 170 mg, and discarded the rest. With the introduction of 13 days after fertilization, the queens of the nuclei were removed, weighed and introduced in the experimental apiary of hives of Bela Vista-PI. The average weight of the queens to emerge and after fertilization obtained in the rainy season was 201,71 mg $\pm$16,91 and

±8,84 and 209,34 mg ±11,16, recorded in the dry period, respectively. There was no significant relationship (P <0.01) weight of queen to emerge with weight and this queen impregnated with honey production, and significant (P <0.05) in weight ratio of queens to emerge with honey production, in the rainy and dry. Queens produced in the rainy season gets more weight to emerge and after fertilization and its colonies are more related to the production of honey.

Index terms: *Apis mellifera*, climatic conditions, fertilized queen weight, weight of virgin queen, honey production

INTRODUCTION

The success of beekeeping is directly related to the development of the colonies and their productivity, so it is important to maintain young queens and with good provenance in the colonies. The production of good queens depends not only on the genetic quality of the arrays used, it is necessary to observe other factors related to the process of creation, such as time, weather conditions, food and the type of hive used recreates (RUTTNER, 1983). All these factors are related to important features in the performance of queens created. For Winston (2003), the weight of the queen is influenced by the size of the colony where it was created, and to Silva (1996), its size is related to age of larvae used for its creation.

Woyke (1967) observed that the heavier is the queen the greater is the spermatheca and the greater its volume to store sperm. Souza et al. (2002) states that as the amount of royal jelly given, larvae present greater body weight at birth, the greater number of ovarioles and spermatheca diameter.

However, other researchers believe there is no clear relationship between the weight of the queen to emerge and the number of their ovarioles (CORBELLA, 1981; MORINI and BUENO, 1993), but with the performance of the colony and its fecundity (Nelson and Gary, 1983). As Woyke (1967) the weight, volume and number of ovarioles of the spermathecal of the queen decrease with increasing larvae age of the working used for their development.

Although the live weight changes after emergence, birth weight is a desirable feature in order to select queens (SZABO, 1973). Studies addressing the weight of newly emerged Africanized queens show the existence of variation of this parameter, taking Gonçalves and Kerr (1970) obtained a mean weight of 199.32 mg, while Garcia et al. (2000) and Costa (2005) could mean 175,4 mg and 178,18 mg, respectively.

In research conducted by Souza et al. (2000), evaluating the size of cupules and the queen´s weight in emerge during May, June and July in Teresina-PI, found an average weight of 213.75 mg, while Morini and Bueno (1993) in Rio Claro-SP found the average weight for Africanized queens emerging from 233.63 mg and concluded that the weight is influenced by the characteristic time of the year in which the queen is produced.

However Teixeira (1993), assessing the behavioral aspects and factors influencing the fertilization of queens of *Apis mellifera* in Ribeirão Preto-SP, found the average weight of 156.96 mg and 227.78 mg for virgin and fertilized queens, respectively, the months of December and January (summer), and similarly, Silva et al. (1993) in Pindamonhangaba-SP, found that the mean weight of newly emerged queens obtained in May and June ("winter") was lower (156.66 + 2.38 mg, P <0.05) than those produced between January and March ("Summer") (173.81 + 2.29 mg).

As Kerr et al. (1970), 210-240 mg is an optimal weight for Africanized queens. Thus, Gonçalves and Kerr (1970), suggest that they are introduced into hives, only queens that have at least 200 mg in weight, to ensure greater longevity.

Given the recommendations for use only in emergency queens weighing 200 mg, it is important to note the variations of this parameter under the Northeast conditions. Thus, this study aimed to verify the weight of Africanized queens to emerge relating to the production of honey in the semi-arid region of Piauí.

MATERIAL AND METHODS

The production of queens was conducted during the rainy season (February-March) and dry (October-November) of 2008, in the Division of Apiculture, Federal University of Piauí (FUPI), located in the middle region of Teresina-PI, with latitude 05 ° 05'21 "S, longitude 42 ° 48'07" W and altitude 72.7 m, annual average rainfall of 1360 mm and temperature between 22.1 ° C and 33.8 º C with climate transition sub-humid, distinguishing two seasons, rainy and dry (Bastos and Andrade Junior, 2000).

Queens were produced from the hive matrix selected in the municipality of Bela Vista-PI. This hive was selected because it has always good supply of food (honey and pollen), large population of bees, an aggressiveness average, a good number of offspring (eggs, larvae, pupae) and absence of natural predators, even during off-season. In the production of queens was used three mini hives with Africanized queens, composed of two groups of five overlapping frames and separated by a screen excluder (GARCIAL et al. 2000).

It was adopted the method of Doolitle (1899) for the production of queens, which consisted in the transfer of larvae with approximately aged of 24 h to artificial plastic domes containing royal jelly diluted in distilled water (1:1). Each mini hive has received a frame with 20 domes, staying for 24 h in the colonies where the queens were created to absorb the odor of the family. Two weeks before, and during the experimental period, twice a week, the honeycomb matrix and each mini hive received 500 mL of syrup of water and sugar prepared according to the modified method of Lengler et al. (2000) in feeders cover type.

On the tenth day after the transfer, the queen cupules were removed from the mini hives taken to the laboratory and incubated with biological temperature between 34 and 35 ° C until emergence of queens. Soon after emergence, queens were weighed on an analytical accurate balance to 0.0001 g, selecting the 25 weighing less than 170 mg, which were labeled, placed in cages for introduction and taken to the core for fertilization. After three days, there was acceptance of the queens, and, after 13 days of introduction, after confirmation of fertilization, the queens of the nuclei were removed and weighed again. The heaviest 20 queens were selected to be introduced in the hives in the apiary experimental in Bela Vista-PI. In October and November dry season the same procedures were repeated to obtain the queens.

It was adopted experimental design with two treatments (weight of the emerging queen and weight after fertilized), two periods (rainy and dry) and 20 repetitions (hives). The data collected were subjected to analysis of variance (ANOVA) and means compared by Tukey test at a significance level of 5%.

RESULTS AND DISCUSSION

There was great variation in rainfall, average temperature and relative humidity between the periods of breeding and insemination of queens (Table 1).

Picture 1 - Data on precipitation (mm), average temperature (° C) and relative humidity (%) in the rainy and dry period in 2008 in Teresina-PI

Climatic factors*	Rainy period		Dry period	
	February	March	October	November
Precipitation (mm)	175	273,42	8,68	14,4
Temperature (°C)	26,3	25,62	37,8	30,8
Relative moisture (%)	84,21	88,23	53	54

*From: Embrapa Meio-Norte – Teresina/PI.

The average weight of the queens to emerge and after fertilization showed difference (P <0.05) between the rainy and dry seasons (Table 1), this difference may be related to environmental conditions such as availability of food in the wild during the rainy and dry seasons. Silva et al. (1993) found a positive correlation between weight of the queen to emerge and maximum temperature (r = 0.227, P <0.01) and between weight and rainfall (r = 0.275, P <0.01), showing that environmental conditions related the amount of food available influences the weight of the queen to emerge.

Table 1 - Mean weight (mg) of Africanized queens (*Apis mellifera*) to emerge and after fertilization and standard error of mean (ESM) in the rainy and dry seasons in Teresina-PI

Variables	Rainy period	Dry period
Weight at emergence	201,71a*± 16,91	185,43b± 8,84
Weight after fertilization	230,34a± 17,62	209,94b± 11,16

* Means followed by different letters in the same row, differ among themselves by Tukey test (P <0.05).

The average weight of the queens to emerge in the rainy period (February-March) and dry (October-November), was superior to those obtained with Africanized queens by Garcia et al. (2000) in Jaboticabal-SP and Costa (2005) in Maringá, with 175.4 and 178.18 mg, respectively, but lower than those obtained by Morini and Bueno (1993) in Rio Claro-SP, from 233.63 mg and Souza et al. (2000) to 213.75 mg in Teresina-PI. The average weight of the queens to emerge obtained by Gonçalves and Kerr (1970) of 199.32 mg was superior to this research in the dry season, but close to that obtained in the rainy season.

The average weight of the queens inseminated during the rainy season is similar to that obtained by Oliveira et al. (1993), 230.21mg and superior to 227.78 mg obtained by Teixeira (1993) in Ribeirão Preto-SP, indicating that the values for weight after

fertilization achieved in the South can be found in the northeast during the rainy period.

The correlations obtained in the rainy and dry period for the weight of the queens emerge and weight after fertilization and this with the production of honey were significant (P <0.01). Nelson and Gary (1983) study in California, USA, with European bees race found a positive correlation between weight and mated queen honey production (r = 0.39, P <0.01). In both periods, there was also significant (P <0.05) for the correlation weight of the queens emerge and honey production (Table 2).

Table 2 - Correlations for average weight (mg) of the queens emerge and after fertilized and honey production in Bela Vista-PI, in rainy and dry seasons of 2008 and 2009.

Correlations	Rainy period	Dry period
r (Weight to emerge and after fecundation)	0,794**	0,899**
r (Weight to emerge and honey production)	0,681*	0,642*
r (Weight after fecundation and honey production)	0,820**	0,768**

**significant at 1% by Student's t test
* signicant at 5% by Student's t test.

Comparing the weight to emerge and after fertilization of the queens and honey production for the two periods in study, it was obtained higher values (P <0.05) in queens produced in the rainy season (Table 3), indicating that queens when produced during the rainy season will be heavier and more productive.

Given the results indicates to the northeast, the rainy season, as the best time for breeding of queens that meets the recommended minimum weight of 200 mg (GONÇALVES and KERR, 1970).

Table 3 - Average weight of queens (mg) to emerge and after fertilization and honey production (kg) and standard error of mean (SEM) in Bela Vista-PI, in rainy and dry seasons of 2008 and 2009

Variables	Rainy period	Dry period
Weight to emerge	201,71a*± 16,91	185,43b± 8,84
Weight to fertilized	230,34a± 17,62	209,94b± 11,16
Honey production	37,800ª± 6,48	32,40b± 8,05

* Means followed by different letters in the same row differ from each other by Student's t test (P <0.05).

CONCLUSION

Under the conditions of Teresina-PI the queens rearing results in heavier individuals when produced in the rainy season, taking the average weight for this period reached the minimum recommended value of 200 mg.

Queens that emerges with greater weight is heavier after fertilization and its colonies are more productive.

There is high correlation between weight at emergence and after fertilization and honey production, allowing weight to the adoption of emerging as a selection parameter in the production of queens to increase the productivity of the colonies.

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