Acceptance rate of Africanized honey bee larvae in hives maintained in the shade and under full sunlight in Northeast Brazil

ABSTRACT
In the Semiarid region of Northeast Brazil, adverse environmental conditions such as high radiation and temperature affect the balance of homeostasis of the colonies of Africanized honey bees (Apis mellifera L.). This research aimed to evaluate the rate of acceptance of Africanized honey bees larvae (Important stage of process of queen-rearing) in hives installed in the shade and under full sunlight in the semiarid climate of Northeastern Brazil. 10 colonies of honeybees (5 in the shade and 5 under full sunlight) were orphaned and prepared with young workers and food, having standardized biomass (equal population conditions) to receive frames containing 60-100 queen cell cups with larvae up to 24 hour-old. The acceptance percentage of transferred or grafted larvae to each colony was measured 72 hours after carrying out transfers and means were compared by the Student’s t-test at 5% probability. The colonies under shade conditions showed acceptance rate of 68.82 ± 17.03%, significantly higher (P = 0.0044) than the colonies subjected to direct sunlight with only 52.13 ± 16.29%. Thus, for the production of queens and royal jelly of Africanized honeybees in the semiarid climate of Northeast Brazil, it is strongly recommended the installation of apiaries in shady locations.

Taxa de aceitação de larvas de abelhas africanizadas em colmeias mantidas em sombreamento e sob exposição solar direta no Nordeste Brasileiro

RESUMO
No Semiárido do Nordeste Brasileiro, as condições adversas do ambiente como alta radiação e temperatura afetam o equilíbrio da homeostase das colônias de abelhas africanizadas (Apis mellifera L.). Este trabalho objetivou avaliar a porcentagem de aceitação de larvas de abelhas africanizadas (etapa importante do processo de produção de rainha) em colmeias instaladas à sombra e sob radiação direta do sol na região semiárida do Nordeste Brasileiro. Para isso, 10 colônias (5 no sol e 5 na sombra) foram orfanadas e tiveram a biomassa padronizada para receber quadros portando de 60 a 100 cúpulas contendo larvas com até 24 horas de vida. O percentual de aceitação das larvas transferidas para cada colônia foi avaliado 72 horas após a realização das transferências e os dados foram comparadas pelo teste t-Student a 5% de probabilidade. As colônias sob condições de sombra apresentaram taxa de aceitação de 68,82 ± 17,03%, sendo significativamente maior (P = 0,0044) do que as colônias submetidas à radiação direta do sol, com apenas 52,13 ± 16,29%. Conclui-se que para a produção de rainhas e de geleia real de abelhas africanizadas no semiárido nordestino, torna-se extremamente recomendável a instalação de apiários em locais sombreados.
INTRODUCTION

Brazil has special characteristics of flora and climate, which associated with the presence of Africanized honeybees, give it a fabulous potential for beekeeping (FERREIRA et al., 2012). In the Northeast region, honey production represents approximately one third of the national production, which is equivalent to 30% of Brazilian honey exports (GONÇALVES, 2004). Furthermore, the honey produced in the Northeast is much appreciated by the exporters, since it is originated from a rich natural flora free of pesticide contamination.

However, the climatic instability of the semiarid region of Northeast Brazil has compromises the productive success of beekeeping. For example, the high temperatures resulting from the strong radiation of this region and the frequent drought are often limiting factors for the thermoregulation of the colonies (ALMEIDA, 2008), causing physiological and behavioral changes in the individuals, as the migratory behavior or absconding, that adversely affects the productive performance of the bee colonies (DOMINGOS & GONÇALVES, 2014). Additionally, it is common among northeastern beekeepers the absence of the practice of queens replacement, activity that represents an important aspect of the honey productive chain (VILELA & PEREIRA, 2002, PEREIRA et al., 2013). Most beekeepers in northeastern Brazil do not substitute queens in the colonies because they cannot master the process of queen-rearing. Some reports have mentioned an apparent difficulty in the handling of this technique, mainly in the transfer of young worker larvae into cell cups made of wax or plastic (grafting). After grafting of larvae, they are transferred these queen cell cups to colonies previously prepared so that the bees sense that they do not have a queen and are induced to rear new queens. However, this process is sensitive to the influence of climatic factors and if the ambient conditions are not good, the transferred larvae may not be accepted by the colonies.

The technique of transferring larvae is an important and refined method for commercial production of royal jelly and queen rearing of Apis mellifera, therefore is important that beekeepers dominate it.

The practice to protect hives with vegetation in order to provide shade for the bees is an alternative beekeeping method that mitigates the adverse environmental effects very common to the semiarid region of Brazil, what significantly reduce the stress caused by high temperatures (LOPES et al., 2011; SOMBRA, 2013) and this may be useful for improving the queen rearing in the semiarid. Thus, the production of breeding systems that provide a reduction of heat stress in animals from tropical countries is an interesting strategy to improve production. However, with regard to methods to avoid heat stress on honey bees the means of acceptance larvae until the end of grafting. 2 hour-old larvae were transferred (grafted) following Doolittle’s method (1899) from the brood comb cells to acrylic cups (artificial queen cells) containing one drop of royal jelly diluted in distilled water (proportion of 1:1) (see Figure 1). The hives were orphaned two days before each grafting and prepared with comb containing young worker bees and food. It is placed over a normal 10-frame Langstroth hive body. The ten-frame hive is filled with six brood frames, three feeder frames and one grafting frame (queen-cells frame).

Frames containing 60-100 acrylic cups were introduced in 10 colonies without queen (orphan), 5 of which were exposed directly to sunlight (control) and the other 5 colonies were maintained in the shade conditions (cover made from logs and leaves dehydrated trees and known in the Brazilian Northeast as “latada”) (see Figure 2), totaling 2560 transferences at the end of the experiment (see Table 1).

RESULTS AND DISCUSSION

The Table 1 shows the number of transferences (graftings) and the acceptance percentage of grafted larvae in queen-cells frames in both groups of the experiment. The cups occupied by live larvae and filled with royal jelly were a general requirement for acceptance.
The warm climate of the Brazilian semi-arid region requires a greater effort of worker bees in thermoregulation, time that could be used in activities of growth and production of the colony (BRASIL et al., 2013), so that the percentage of accepted larvae and the success of larvae transfers may be affected in the hives exposed to direct sunlight, as observed here. According to Seeley (2006), the cooling system or the thermoregulation is triggered when the nest temperature reaches about 36°C. However, when the temperature inside the colonies reaches 41°C occurs the migratory swarming or absconding of the Africanized bees (ALMEIDA, 2008). Thus, due to high temperatures common in semi-arid region, the bee colonies need to invest frequently in thermoregulation of the hives.

In this research, the greater acceptance rate of grafted larvae presented for hives kept under shade conditions possibly indicate that under mild environmental conditions (shade), the honey bees are able to maintain the colony homeostasis more easily and with more accuracy (ALMEIDA, 2008; DOMINGOS & GONÇALVES, 2014), providing a suitable environment for the development of queens. Thus, our results demonstrated clearly the interference of high temperatures and intense radiation as limiting factors of the physiological and behavioral performance of Africanized honey bees exposed to direct sunlight, reinforcing the theory that the A. mellifera colonies are sensitive to climatic factors of Caatinga.

Therefore, the process of transferring larvae for queen-rearing or royal jelly production can be successfully carried in this region, when combined with the correct management of hives such as installation of bee colonies under shady area.

CONCLUSION

It is concluded that colonies installed in the shade have a higher acceptance rate of Africanized honey bees larvae than colonies under full sunlight. Thus, for the production of queens and production of royal jelly in the semi-arid region of northeastern Brazil, it is strongly recommended to install aprieries in shady places.

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