

SURVIVAL OF AFRICANIZED HONEYBEE *Apis mellifera* Linnaeus, 1758 (Hymenoptera: Apidae) REARING WITH ENERGETIC AND PROTEIN DIETS

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INTRODUCTION

The survival of africanized honeybees *Apis mellifera* L., under confinement conditions constitutes a complex and important analysis, being influenced by a number of factors, such as the diet availability. It's common under natural conditions, where scarcity of food is verified in determined times of the year, the migration of swarms where those resources are not limiting. However, management tactics aim to minimize this fact through a food supplementation, promoting the necessary conditions of survival and development of the colony, avoiding its abandonment.

Considering the importance in the food supplementation, this work was carried out to evaluate the laboratory survival of *A. mellifera* when these were fed with energetic and protein diets.

MATERIAL AND METHODS

Africanized honeybees were obtained at the frames of a colony, anesthetized with CO₂ for 120 s, individualized in number of ten (and ten replicate for treatment) and placed into cylindrical cages of 15 cm x 10 cm, covered with tulle in top and bottom. All cages were maintained at 28±2°C, RH 70±10% and 12-hour photophase. To evaluate the survival of confined bees, we used diets made with energetic and protein source.

➔ Energetic diet (50% aqueous solutions w/v):

- Honey - Fructose - Candy paste - Water (as control)
- Commercial sucrose (sugar cane) - Commercial sucrose + 1% tartaric acid
- Commercial sucrose + 5% of "cravo" lemon juice (*Citrus limonia* Osbeck)
- Gludex® (commercial inverted syrup from Dulcini/Brazil)

➔ Protein diet (3 parts crystallized honey + 1 part of protein compound):

- Bee pollen - Wheat germ - Rice flour - Rice bran - Corn cream
- Brewer's yeast - Soybean flour - Crystallized honey (100%; as control)

In both experiments, the number of honey bees dead was counted at regular 12-hour interval, even when the death of the last bee occurred. The survival rate was performed using the adjustment of the curves done by the Weibull distribution. With the adjustment, the effect of each diet was investigated by the maximum likelihood estimate and the lethal time (LT) for the intervals 10; 50 and 99% were determined.

RESULTS

➔ Energetic diet – There is an important variation of survival of *A. mellifera*, the longest average however the longer life expectation was observed when the honey bees were fed with commercial sugar + "cravo" lemon juice (LT₅₀ 190.17h), followed by Candy paste (LT₅₀ 180.98h), and the mortality after 240h was 63 and 70%, respectively. The diets honey, commercial sugar, commercial sugar + tartaric acid and fructose, showed mortality at 240h ranged from 81 to 87%, and LT₅₀ 134.8 to 163.57h. To the Gludex® mortality was 96% and LT₅₀ 118.16h. It was found, that the commercial sugar + "cravo" lemon juice is the best choice for the experiment with longer duration (more 5.8 days), being the Candy paste for the short times (Table 1 and Figure 1).

➔ Protein diet – No differences were found between all protein diet over the average life time being that only with crystallized honey showed the longer expectative of survival, at LT₅₀ 98.80h, while the mean of survival for the others was of 26.43h. The short survival of crystallized honey in this assay in comparison with that energetic diet, is based that all protein diet show a short life expectative, being then this assays had maximum duration of 72h and other 240h. Same with the variability of protein content in the different foods, it was found that the mortality is greater at 72h, with average of mortality the 96.85%, except for crystallized honey (19%) (Table 2 and Figure 2).

Table1. Lethal time (LT±EP) (hours) and mortality (%) of *Apis mellifera* fed high energy diets after 240 hours.

Treatments	Lethal time			Mortality (%) after 240 hours
	TL ₁₀	TL ₅₀	TL ₉₉	
Honey	86,39 ± 5,85	161,15 ± 6,30	301,57 ± 10,98	87,0 ± 2,91
Commercial sucrose	55,10 ± 5,83	137,45 ± 8,12	344,74 ± 20,19	81,0 ± 3,48
Commercial sucrose + 1% tartaric acid	77,50 ± 6,49	163,57 ± 7,68	346,56 ± 14,48	81,0 ± 4,82
Commercial sucrose + 5% lemon juice	86,23 ± 8,77	190,17 ± 9,50	421,13 ± 25,81	63,0 ± 2,13
Gludex®	61,49 ± 4,13	118,16 ± 4,81	227,86 ± 8,63	96,0 ± 2,21
Fructose	56,76 ± 5,49	134,80 ± 7,28	321,56 ± 17,17	83,0 ± 4,67
Candy paste	87,88 ± 8,41	180,98 ± 8,11	374,09 ± 22,50	70,0 ± 7,30
Water	3,44 ± 3,01	17,56 ± 6,34	90,42 ± 9,15	100,0 ± 0,0

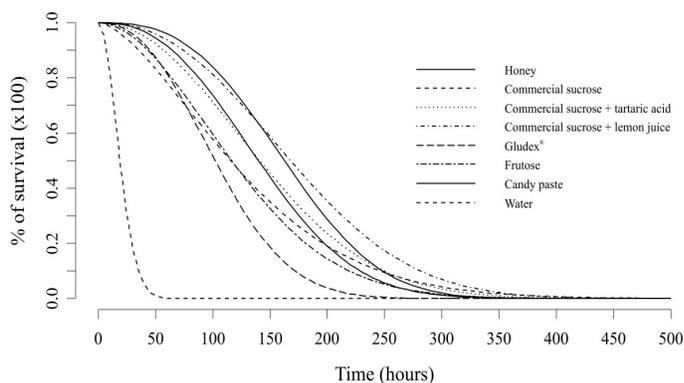


Figure1. Survival of *Apis mellifera* as related to the high energy diets over time

Table2. Lethal time (LT±EP) (hours), mortality (%) of *Apis mellifera* fed high protein diets after 72 hours and protein content of each diet.

Treatments	Protein content (%) ¹	Mortality after 72 hours	Lethal time (hours)		
			TL ₁₀	TL ₅₀	TL ₉₉
Pollen	14,70	100,0±0,0	15,52 ± 1,30	27,71±1,12	49,64±2,09
Wheat germ	22,00*	100,0±0,0	11,08 ± 1,48	23,21±1,24	48,82±3,57
Rice flour	16,00	97,0±1,53	8,09 ± 1,55	25,15±1,99	78,70±7,85
Rice bran	14,00	93,0±3,96	8,93 ± 1,57	25,49±1,90	73,16±6,74
Brewer's yeast	41,00	98,0±1,33	15,86 ± 1,57	33,08±1,56	69,28±4,18
Corn cream	8,00	97,0±3,00	11,74 ± 1,48	26,49±1,51	60,05±3,80
Soybean flour	45,00*	93,0±3,00	6,99 ± 1,60	23,94±2,19	82,56±9,61
Crystallized honey	-	19,0±4,07	59,82 ± 4,36	98,80±9,62	163,63±32,94

¹ Protein content obtained by analysis performed in the Bromatology Laboratory/UFLA. *Values given by the manufacturers.

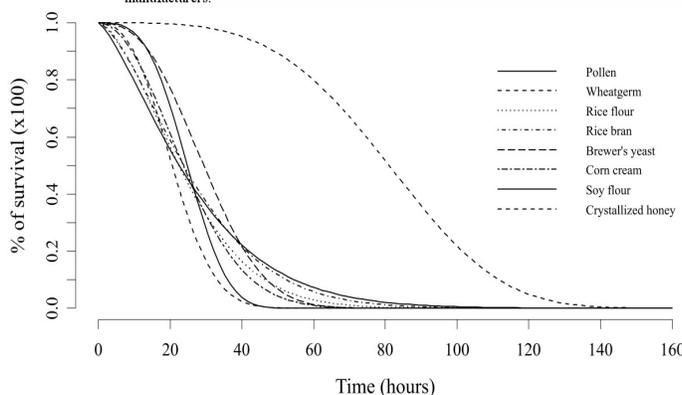


Figure 2. Survival of *Apis mellifera* as related to the high protein diets over time.

CONCLUSIONS

- The survival of adults of *A. mellifera* when fed an aqueous solution of sucrose added of 5% "cravo" lemon juice was higher than the other tested diets.
- The survival of adults of *A. mellifera*, maintained in laboratory did not differ among the evaluated high protein diets.
- For adults of africanized bees *A. mellifera* kept in laboratory is not necessary to add a protein source to the high energy food to increase the worker bees' survival.