INFLUENCE OF TIMING AND PRODUCTION METHOD OVER THE QUEEN BEES' PERFORMANCE PARAMETERS

Sena Lumturi Sena Sabah, Gjurgji Fidel

Department of Animal Production ,Faculty of Agriculture and Environment, Agricultural University of Tirana, Albania

(e-mail: lumturisena@yahoo.com)

ABSTRACT

Three methods of queens' production in different time periods were applied, tested and with each other compared, meanwhile, the best time of production and growing of efficient queen-bees was studied according to:

Aliev's method; Jenter's method and Planting method. The study was performed, within a three months period, divided into two phases; phase I: June–July and phase II: July – August.

After testing, it resulted that during the first phase, the queen-bees had the most optimal performance parameters. Jenter's method resulted to be more efficient regarding the hatching time of the queen bees (7.2 hours quicker than those produced according to Aliev's and 14.4 hours quicker than the planting method) during the first phase. Egg production (respectively 11.5% and 6.3% more eggs compared to the Aliev's and Planting method) during the second phase. Planting method resulted to be more efficient during the second phase for the following parameters: Time of emergence; Time of mating; Body weight.

During the first phase, the queen-bees produced according to Aliev's method resulted to be more superior as far as the ***mating parameters*** (9 days after hatching), ***egg production*** (2.1% more eggs produced compared to the Jenter's and 23.1% more eggs than the ones produced according to the "planting" method) and the ***body weight*** are concerned.

Out of the two factors considered in this research, (time and production method) time's influence seems to be more indicative.

Key- words*: Queen bee, mating nucleus, cell sealing, emergence, mated queens, method of queen bee production*

INTRODUCTION

Queens' fertility is a fundamental factor that directly influences on creating strong bee colonies, meanwhile it is a good possibility of having a quiet winter period for the family, having a healthy family and a good preventive measure against the different diseases and an efficient use of feed reserves as well, which directly influences on the honey production. *(Thomo.K, Sena.L, etj).*

The presence of a new & vital bee queen of a known genetic origin is essential in having a successful honey production in a bee family. Regular replacement of the bee queen is a key factor in having quite, hard working and productive bee families *(Greer P, 2005).* Reproductive capabilities of the bee queen depend a lot on its age and growing conditions *(Nuri. Q).*

Queen bee growing should be done only when the circumstances allow a good acceptance of the "grafted" larvae, good growing rate and effective mating flight. An important biological peculiarity of the bee family is the ability to grow queens using the new larvae of 1-3 days old age.

The most effective period of time used to grow bee queens in Albania is the one between, May 15th – July 15th and more seldom during August.

Artificial queen growing is in general a qualified job; it is done when the production of a large number of queens is needed.

The advantages of the "Artificial Queen Bees Production" are the following:

- Queens are produced in the appropriate time and quantity, according to our needs;
- Queens come from the carefully selected vigorous and productive bee families.
- In this way we avoid the risk of getting queen bees from unknown and/or unsafe bee families.

Based on the above statement, this research was performed in order to study the possibility of producing bee queens (through moving and not moving the larva's) during the June – August 2005 season.

The general objective was to asses the performance parameters of bee queens in relation with the time and growing method of them.

Ways of realising the study:

- *Experimentation in time of different methods of queen bees production (three methods)*
- *Comparison of the end results of each method and for each phase of study.*
- *Definition of the most effective time and method for the queen bees' production.*

MATERIAL AND METHOD

The research was realised in an intensive growing bee farm. Based on the principles of comparative analogy, the three strongest bee family of the farm were selected, considering their:

- Breed;
- Age and;
- Strength of the family.

The experiment was performed during June 24 – August 19, being divided into two phases, respectively:

- First phase: June 24 – August 05;
- Second phase: July 12 – August 19.

During each phase one egg planting was applied. During this time the local fodder condition for bees (availability of pollen and nectar) was good.

During the technological process of queen bees' production, the following parameters were recorded (for each of the applied method and phase).

- The timing of queen bee emergence
- The progress of mating and start of laying;
- Egg production of the mated queens in nucs *(for each of the applied method and for every phase);*
- Body weight of the mated queens (mg).

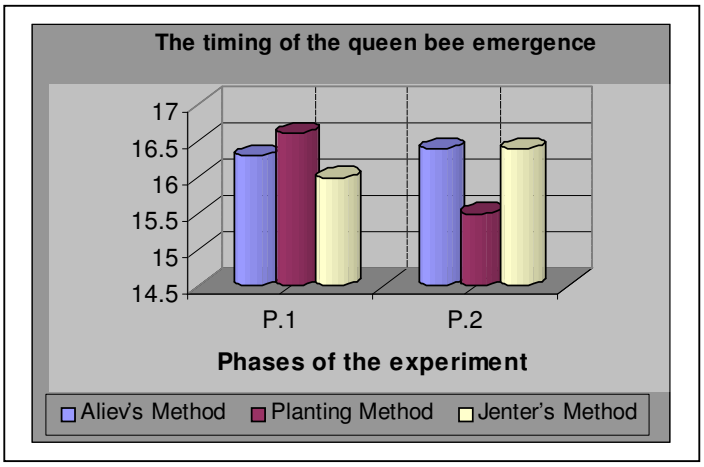
During the whole time of the study, the temperature and the humidity were recorded and monitored, and the end results were statistically processed with ***ANOVA*** and ***Descriptive Analyses*** methods.

RESULTS AND THEIR INTERPRETATION

1. The time of queen bees' emergence *(for each of the applied method and experiment's phase).*

This parameter is strongly related with their vitality.

Graph 1: Timing of the queen bees' emergence *(days)*



Let's study and discuss the influence of ***time factor*** within the group where Aliev's Method was applied *(A. M).*

On the table 1 it is clearly evident that there are no time differences for this method, on the queens' emerging time during the two phases of the experiment.

As far as the "planting" method is concerned, it can be seen that during the second phase, the queens have emerged earlier (one day) than the first phase. Meanwhile the differences are statistically true for this parameter ***(T_{stat} = 3.592 and T_{crit} = 1.860)***. This fact can be justified with the egg selection process. Most probably, during the second phase the eggs laid on the beginning of the 24 hours period (the time that the queen was allowed to lay eggs) have been selected. The favourable weather temperatures/conditions during the second phase have influenced as well *(the queens' emerging has reached the level of 50% at the 15th day)*. While during the first phase, because of the rainfall, a temperature declination (from 32 - 26° C) happened.

According to the Jenter's method, although the differences between the phases of queens' emerge are 0.4 days only, thy are statistically true ***(T_{stat} = 1.890, T_{crit} = 1.860)***. Even within this method there might be a time difference related to the egg selection and experiment's continuation.

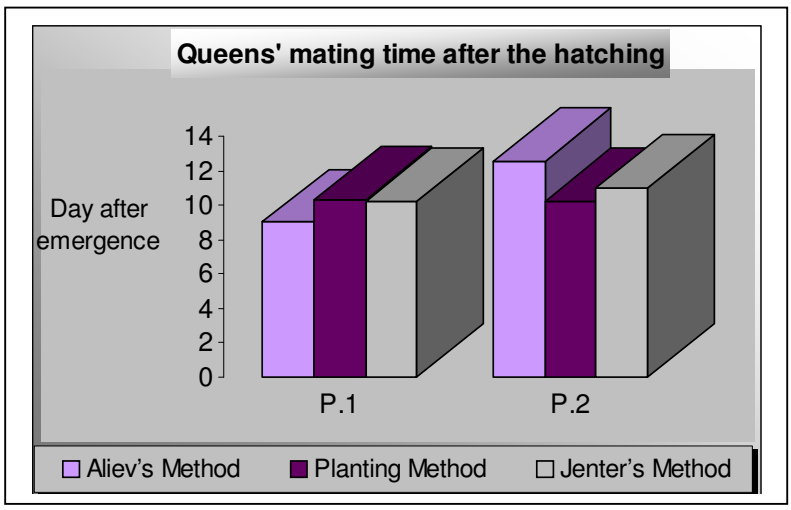
So, it can be concluded that according to the Alievi's method, the *"phase"* factor has not shown any influence on queens emerge, according the other two methods, the influence of this factor is clearly evident, but anyhow even here there isn't any regularity.

Analysing the *"method"* factor, it can be seen the superiority of Jenter's Method on the Queens' Emerge during the first phase. Although the differences in emerging seems to be apparently small *(0.3-0.6 days*), the ones between the "Planting Method" and "Jenter's Method" are statistically true ***(T_{stat} = 2.800, T_{crit} = 1.860).***

So, it can be concluded that the queens produced with the Jenter's method have had an earlier emerge. While in the other method, (with planting) the bad weather conditions during the larvae transfer process have had a negative influence on the whole process. During the second phase, it can be easily seen the superiority of the "planting" method over the other two methods, and these differences are statistically true.

2. Queens' mating time after their emerging

Graph 2: Comparison of the queens' mating time



Within the group of Aliev's Method, there is a time difference of 3.6 days between the two phases, which is statistically true and strictly related with the environmental temperature, rainfall, the strength of the bee colony, feeding and hive's location. As far as the last factor is concerned, it should be mentioned that the hives/nucleus are divided into four parts, two of which are West oriented and the other two ones, East oriented. The cells located in the East-oriented compartment do emerge earlier than the other ones. But one of the reasons for the time delay during the second phase is the rainfall during this phase, which delayed with 2-3 days the mating flights of the queen.

While, within the group where the "planting" method was applied, the time difference is insignificant, because in both phases, the nucleus' entrances had the same orientation/location (east oriented). The same thing can be stated for the Jenter's method, although during the second phase, the mating time delays with *0.8 days (19.2 hours).*

The influence of "method" factor on the queens' mating time

Insignificant differences in value, between the groups, were observed during the first phase. While, during the second phase, within the group where the Aliev's method was applied, there is a delay (about 2 days) in the mating time in comparison with the other two groups. The differences are statistically true only between the Aliev's and Planting method. The time differences between the groups could have been smaller if the nucleus would have been better oriented. Anyhow, within all the three groups, the mating time of the queens is within the optimal parameters.

Table 1: Summary of the progress of growing parameters (M ±SD)

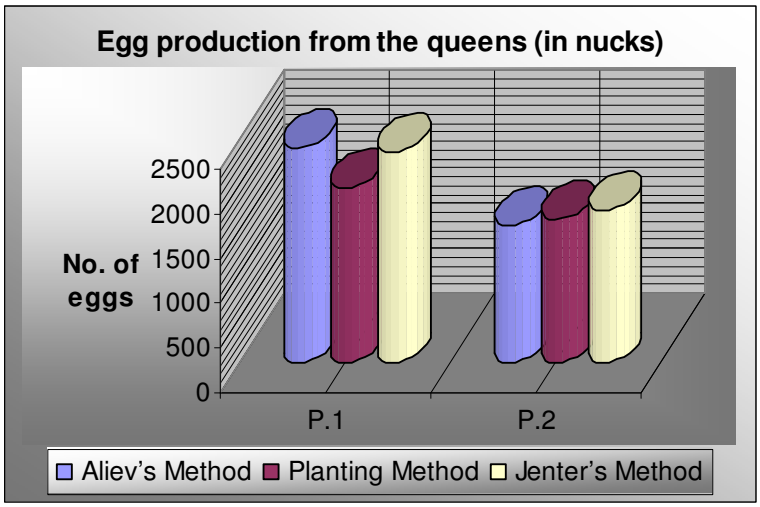
Phases of the experiment	Parameters	**Aliev's Method**	**Planting Method**	**Jenter's Method**
P.1	The timing of queen bee emergence	16.3 ± 0.483	**16 ±. 0667**	16.6 ±0.516
	Queens' mating time	**9 ± 3.972**	10.2 ± 0.632	10.3 ±0.823
P.2	The timing of queen bee emergence	16.4 ± 0.516	16.4 ± 0.516	**15.5 ±0.527**
	Queens' mating time	12.6 ± 1.776	11 ± 2.0	**10.2 ±2.573**

3. Egg production from the queens (in nucks)

In general, the queens considered as "good quality ones" should have a bigger live weight, a bigger number of ovum within the ovaries, and a bigger number of spermatozoids within the sperm theca *(Van Eaton, 1986).* Anyhow, other researches have shown that these physical characteristics of the "good quality queens" are direct consequences of the feeding process during their development phase/period. As a matter of fact, one of the physical characteristics, the number of ovum within the ovaries, is widely influenced by the age on which the larva of the working bee is changed into a queen's larvae *(Woyke, 1971).*

All the eggs laid in each nucleus by the queen are counted. The measurement of the generation was done using the ***net frame***, each quadrate of which is 5 x 5 cm and contains 100 cells.

Graph 3: Egg production from the queens (in nucleus) according to the used methods and each phase



The queens of Alievi's Method group have produced the maximum quantity of eggs during the first phase (June – July). This happens because, during this time, there is plenty of feed available (pasture + supplemental feed + sugar juice) and the weather conditions are favourable. Consequently, the colony's strength reaches its peak during this period. The differences in value between the two phases are statistically true for the Aliev's method.

For the "planting" method, although there is a decrease of egg production in nucleus during the second phase, the differences between the two phases are statistically not true.

The differences in value for the Jenter's Method are significant. So, it can be concluded that the season has a strong influence on the egg production in the nucleus. The superiority in egg production is evident in June – July period of time.

The influence of "time" factor for this parameter:

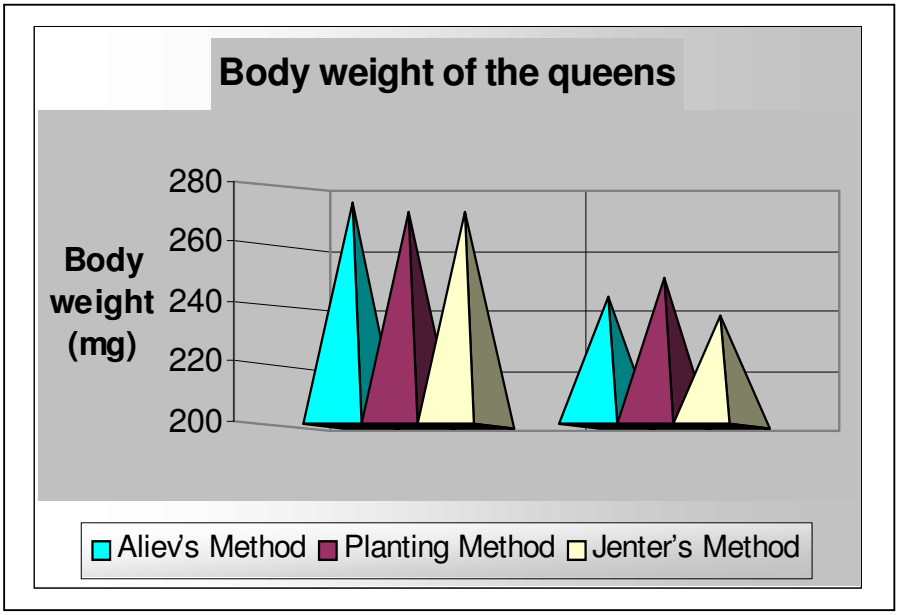
During the *first phase,* it can be seen a lower production within the group where the queens were produced through the "planting" method. This is related with the strength of the colony (within the hive there were less adult bees). The differences are significant between the Alievi's and planting methods only ***(T_{stat} = 2.342, T_{crit} = 1.833).***

During the *second phase,* it can be seen a decrease of egg production, the Alievi's method group has a lower egg production in nucleus, in comparison with the other two groups. But the differences for this parameter are significant between the Alievi's and Jenter's methods only.

4. **Body weight of the mated queens**

The queens were weighed at the end of each phase of experiment. The weighing process was done with a special weighing unit made of silver.

Graph 4: *Queens' weigh (milligram) according to the phase and applied method*



It can be seen that for all the three groups, the maximum body weight of the queens is reached during the first phase (*June – July).* The differences in value are statistically true. The bigger body weight of the queens during the first phase relates with the availability of plenty of feed (royal jelly). During the second phase the queens' body weight decreases because of feed limitation (poorer pastures).

During the first phase the queens' body weight is approximately the same. While, during the second phase, it can be seen a lower body weight of the queens produced according to the Jenter's method. The differences between the Alievi's and Jenter's method and the ones between the planting and Jenter's methods are significant. The lower body weight of the queens produced according to the Jenter's method can be related with the poorer feeding of the queens during the larval stage. The average weight of these queens compares well with queen weights observed in another study *(197-226 mg Rhodes and Someville, 2003)* and also

in overseas queens *(214 mg, Van Eaton, 1996; 200-325 mg Nuri Q, 1980; 180-325 mg., Boreviç B, 1993).*

Tabela Nr. Summary of the performance parameters of the mated queens (M ±SD)

Exp. Phases	Parameters	Aliev's Method	Planting Method	Jenter's Method
Phase 1	Egg Production	**2400 ±524.96**	2350 ±189.73	1950 ±799.74
	Queens' Body Weight	**274.5 ± 10.124**	271.5 ± 10.554	271.5 ±12.921
Phase 2	Egg Production	1525 ±156.43	**1700 ±189.73**	1600 ±323.17
	Queens' Body Weight	243.5 ± 10.288	236.5 ± 6.258	**249 ± 9.369**

CONCLUSION

Considering the time of application of all the three mentioned methods for queens' production, it can be concluded as following:

- *Jenter's Method* resulted to be more efficient for the emerging time *(phase 1)* and egg production *(phase 2).*
- The queens produced through the *planting method*, seem to be more superior during the second phase as far as the growing parameters is concerned (emerging and mating time) and the body weight parameters.
- The queens produced through the *Aliev's method,* have shown a superiority during the first phase, as far as the growing parameters is concerned (mating time) and performance parameters (egg production and the body weight).
- Among the two factors *(time and method*) a stronger influence on the queens performance, was shown by the *"time"* factor.

LITERATURE

1. Anderson D – Improving queen bee production. 2004
2. Clive de Bruyn - Practical Beekeeping, 2003
3. Grooters H J – Influences of queen piping and worker behaviour on the timing of emergency queen rearing in honey bee queens. Insects Sc 34, 181-193, 1987
4. Hatch S, Tarpy D R – Worker regulation of emergency queen rearing in honey bee colonies and the resultant variation in queen quality. Insects Sc 46, 372-377, 1999.
5. Lidaw H H, Eckert J E – Queen rearing, 1962
6. Loper G M – What do we really know about flight behaviour. 1990
7. Mangum W. A. – Queen emergence and swarming 1998
8. Nuri.Q, Thomo K - Rritja e Bletëve, 1980,1984
9. Paparisto K, Balza E – Bimët mjaltore të Shqipërisë, 2003
10. Patricia Greer - Queen bee replacement, 2005

11. Rhodes J – Introduction and performance of queen bees – introductory apiary status and post introduction results, RIRDC Report, Canberra, Australia, 1998

12. Rhodes J, Somerville D - Introduction and early performance of queen bees; some factors affecting success. 2003

13. Tarpy D R, Hatch S – The influence of queen age and quality during queen replacement in honey bee colonies. Animal Behaviour 59, 97-101; 2000

14. Thomo K, Sena L, Maluta V, Shehu L – Bletaria, 2005