Royal jelly production in queen right and queen less breeding colonies

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Abstract

The objective of the study is to determine the effects of the type of the breeding colonies – queen right and queen less on the acceptance percentage of the introduced larvae and quantity of royal jelly produced per queen cell.

The study was performed on the commercial bee hive yard in Kumanovo region in the Republic of Macedonia.

The production of the larvae has been performed using the "Karl Jenter" system for queen bee production.

Eighteen bee hives into Dadat – Blat hive types were involved in the investigation, grouped into two groups according to the type of the breeding colonies (queen right and queen less). Each group has been divided into three sub-groups (20, 40, 60) according to the number of introduced larvae for royal jelly production.

The highest percentage of acceptance of introduced larvae 79,699±0,128 % is determined in the breeding colonies with introduced 60 larvae. Lower percentage was determined in the breeding colonies with introduced 40 larvae (77,677±0,158 %), and lowest with introduced 20 larvae (75,742±0,226 %).

Higher acceptance of introduced larvae for royal jelly production has been determined in queen right colonies (78,887±0,135 %) compared with queen less colonies (76,525±0,138 %).

The estimated marginal mean for quantity of royal jelly produced per queen cell in the queen less breeding colonies is 0,252±0,002 g, and the estimated marginal mean in the queen right breeding colonies is 0,362±0,002 g.

The estimated marginal mean for quantity of royal jelly produced per queen cell for the main effect 20 introduced larvae is 0,300±0,003 g, in breeding colonies with 40 larvae is 0,310±0,002 g and in the breeding colonies with 60 introduced larvae is 0,311±0,002 g.

Key words: royal jelly, breeding colonies

1. Object of investigation

The investigation has been done on the commercial bee hive yard with 100 bee hives, located in the village of Tabanovci, Macedonia.

The investigations have been performed in a two year period with three production cycles in each year and the bees involved in the investigation were kept on the same location.

The goal of the investigation was to define the effects of the:

- Type of the breeding colonies (queenright and queenless)
- Number of introduced larvae

on the acceptance percentage and the quantity of produced royaj jelly per cell

2. Material and methods

2.1 Material

The investigation involved 18 bee colonies of the Dadat-Blat hive types, grouped into two groups according to the type of the breeding colonies (queen right and queen less).

- The first group of breeding colonies were a queen right and the production of royal jelly was done with the presence of a queen bee.
- The second group of breeding colonies was queen less and the production of royal jelly was done without the queen bee in the colonies.

Both groups of bee colonies were strong colonies with a presence of a great number of young bees.

In each group of breeding colonies, three subgroups of breeding colonies were formed:

1. The first subgroup included three bee breeding colonies in which were inserted 20 one day larvae;
2. The second subgroup included three bee breeding colonies in which were inserted 40 one day larvae;
3. The third subgroup included three bee breeding colonies in which were inserted 60 one day larvae;

2.2. Methods

2.2.1 Field methods

Production of larvae with the same age and their transfer has been performed with the Karl Jenter method (Karl Jenter, 1987).

The production process was developed in the following phases:

Day 0 – Locking the queen bee in the Jenter's device

The selected queen bee was locked up in the Jenter's device for laying eggs –laying eggs in the plastic cell foundations, in 24 hour period.

Day 1 – Checking the plastic cells for the presence of eggs

The locked up queen bee, if it is fertilized and of good quality within 24 hours, broods all or most of the plastic cells.

The checkup of the level of presence of eggs was done with a magnifying glass, thus avoiding the direct influence of sunbeams. If the laying is done in the right percentage, the queen bee would be set free by opening the lid.

Day 4 – After 72-76 hours, the plastic cell foundations of the Jenter device produces larvae, which swim into drops of royal jelly. The age of most of the larvae was 12 hours old, the most favorable age for planting.

Planting was done by opening the rear plastic cover and by taking the plastic cells one by one and their incorporation into the plastic parts which imitate the initiated queen cells and the yellow plastic mounts, which were attached to the production frames (brood comb).

There were one or two laths, onto which 10, 20 plastic mounts with plastic foundations were attached, which contained the larvae, and this was all done depending on the number of larvae added to the breeding colony.

The introduction of the larvae, in the first year, was done in varying temperature from 15 to 37°S, and 45-100% relative humidity.

The introduction of the larvae, in the second year, was done in temperatures from 20 to 28°S, and 60-75% relative humidity.

Production of royal jelly in queen less breeding colonies

From the selected bee colonies the queen bee was removed, in order the worker bees to get stimulated to cultivate larvae, out of which "theoretically" would develop the future queen bee. The removed queen bees were moved to the other bee colonies.

In each breeding colony, the open brood was removed and the colony was added with frames with closed brood, as well as young bees from other bee colonies with a toss. In each breeding colony we added two frames with a lot of pollen.

In each breeding colony, depending on which subgroup they belonged, 20, 40, 60 one day larvae were added for further breeding.

The breeding colonies were constantly fed with 350 ml sugar syrup, with 1:1 concentration.

Production of royal jelly in queen right breeding colonies

In this type of breeding colony, the production of royal jelly was made with the presence of a queen bee. The breeding principle was done in a way that the queen bee was located in a lower part of the hive, and was physically separated by a net from the upper part of the hive, in which the production of the royal jelly was made.

In each breeding colony there were 3-4 frames with honey, 3 frames with pollen, and the number of frames with open brood was around 5.

Each breeding colony was constantly fed with 350 ml sugar syrup, 1:1 concentration.

In each breeding colony the following parameters were determined:

- The percentage of queen cell acceptance;
- The quantity of royal jelly in a queen cell;
- The total quantity of produced royal jelly as per production cycles.

2.2.2. Laboratory methods

The Laboratory methods were focused on measurement of the quantity of royal jelly and on addition Chemical analysis according to the AOAC Oficial Methods, envisaged with the New Honey Directive 2001/110 of EU (2001)

2.2.3. Statistical methods

The statistical analysis has been performed using the **SPSS 6.1** programme

General linear model was used:

ANOVA-test and test of estimated marginal means

$Y_{ijk} = \mu + G_i + YC_j + S_k + e_{ijk}$

Influence of the bellow listed factors were examined:

- Presence of queen bees;
- Number of introduced larvae;
- Year and cycle;

3. Results

3.1. Percentage of acceptance of introduced larvae in queen right and queen less breeding colonies

The percentage of acceptance of the introduced larvae for the production of royal jelly depending on the number of introduced cells and the presence of the queen in breeding colonies is shown in Table 1:

Investigated value	$\bar{x}$	σ (s)	Cv
Number of introduced queen cells			
20	76,565±0,387	9,007	11,764
40	78,966±0,307	10,266	13,005
60	81,194±0,280	11,583	14,274
All	79,709±0,188	10,905	13,681
Group (type of breeding colony)			
Queen less	78,710±0,294	11,948	142,748
Queen right	80,671±0,234	9,703	94,156
All	79,690±0,265	10,850	118,452

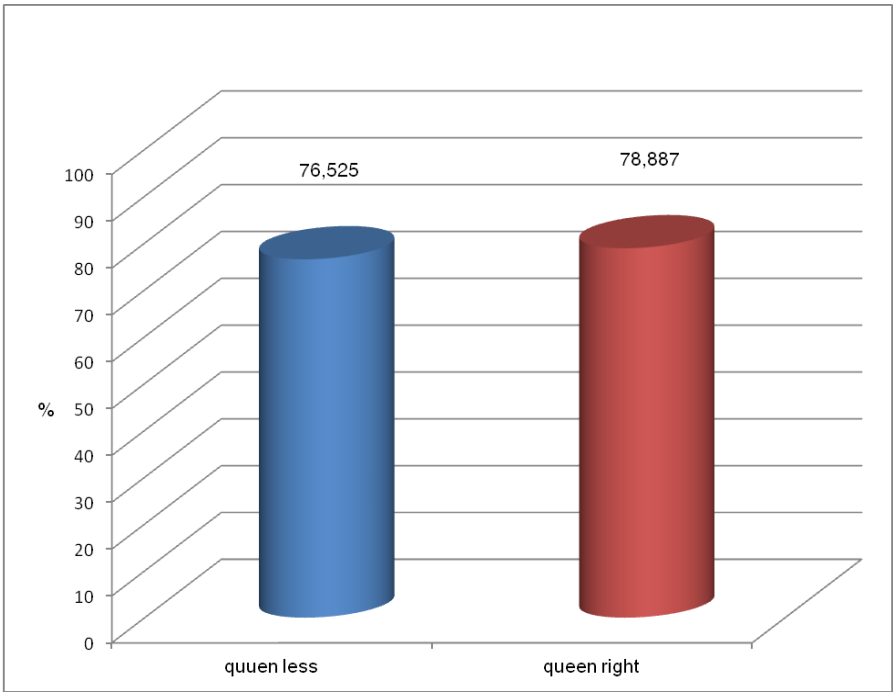
The mean percentage of accepted larvae for the production of royal jelly at bee colonies with 20 cells introduced is 76,565±0,387%, in the bee colonies with 40 cells introduced is 78,966±0,307%, and in the bee colonies with 60 cells introduced is 81,194±0,280%.

The mean percentage of accepted larvae for the production of royal jelly at queen less colonies is 78,710±0,294%, and at queen right is 80,671±0,234%.

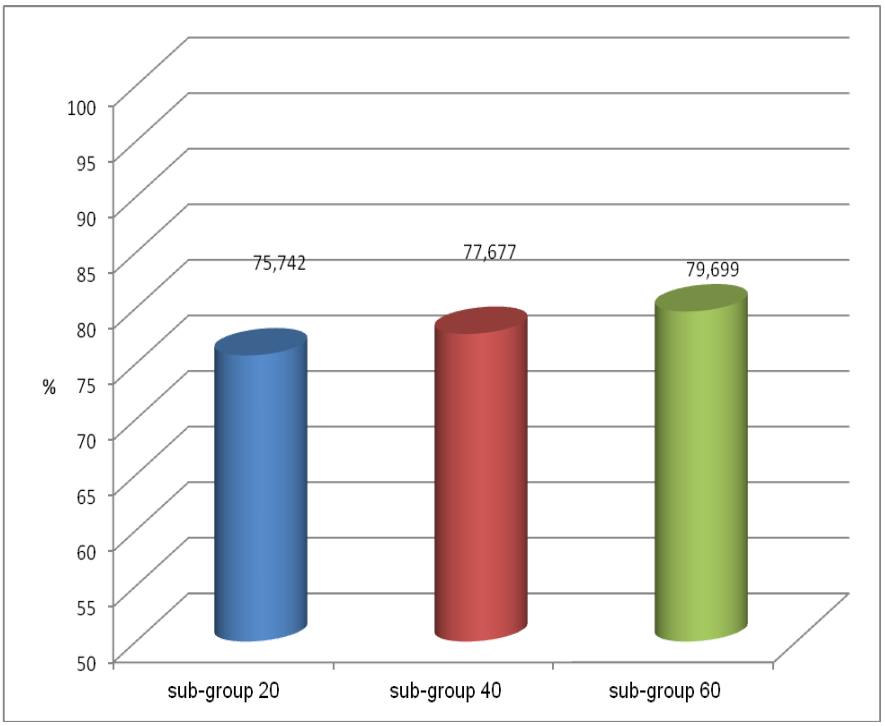
The mean percentage of accepted larvae during the two year research was 79,709%. The minimum percentage of accepted larvae for the production of royal jelly is 40,00%, and the maximum is 96,600%.

The standard deviation of the percentage of accepted larvae for the production of royal jelly is 10,905%, and the varying ratio is 13,681%.

Influence of the factor presence of queen on the percentage of accepted larvae is presented in the graph 1:



Influence of the factor number of introduced larvae on the percentage of accepted larvae is presented in the graph 2:



Quantity of produced royal jelly per cell

The quantity of produced royal jelly per cell depending on the number of introduced queen cells and the presence of a queen in the bee colonies is shown in Table 2:

Investigated value	$\bar{x}$	σ (s)	Cv
Number of introduced queen cells			
20	0,302±0,004	0,085	28,146
40	0,312±0,003	0,084	26,923
60	0,313±0,002	0,088	28,115
All	0,309±0,003	0,083	27,728

Group (type of breeding colony)			
Queen less	0,255±0,002	0,065	25,490
Queen right	0,365±0,002	0,069	18,904
All	0,310±0,002	0,067	22,197

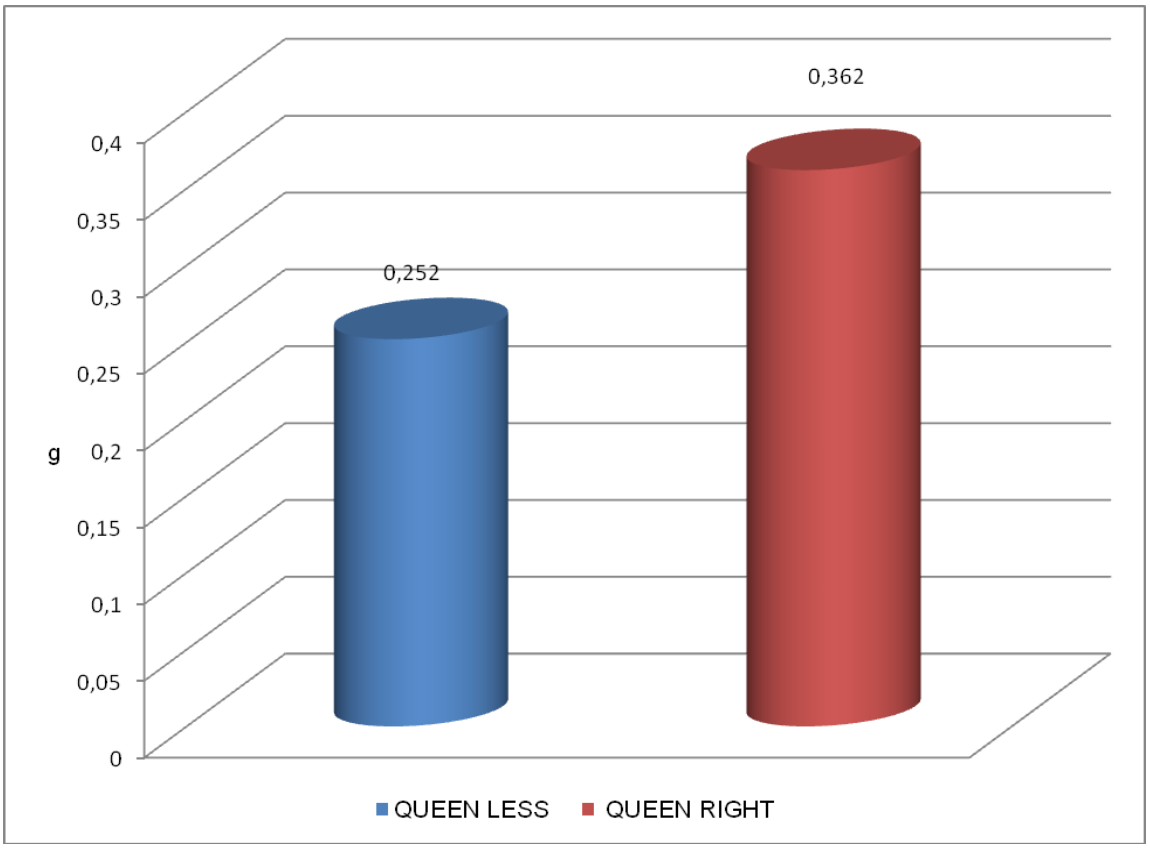
The mean value of produced royal jelly per cell in the breeding colonies with 20 introduced cells is 0,302±0,004 g. In the breeding colonies with 40 introduced cells is 0,312±0,003 g, and in breeding colonies with 60 introduced cells is 0,313±0,002 g.

The mean value of produced royal jelly per cell in the queen less breeding colonies is 0,255±0,002 g, and in the queen right colonies is 0,365±0,002 g.

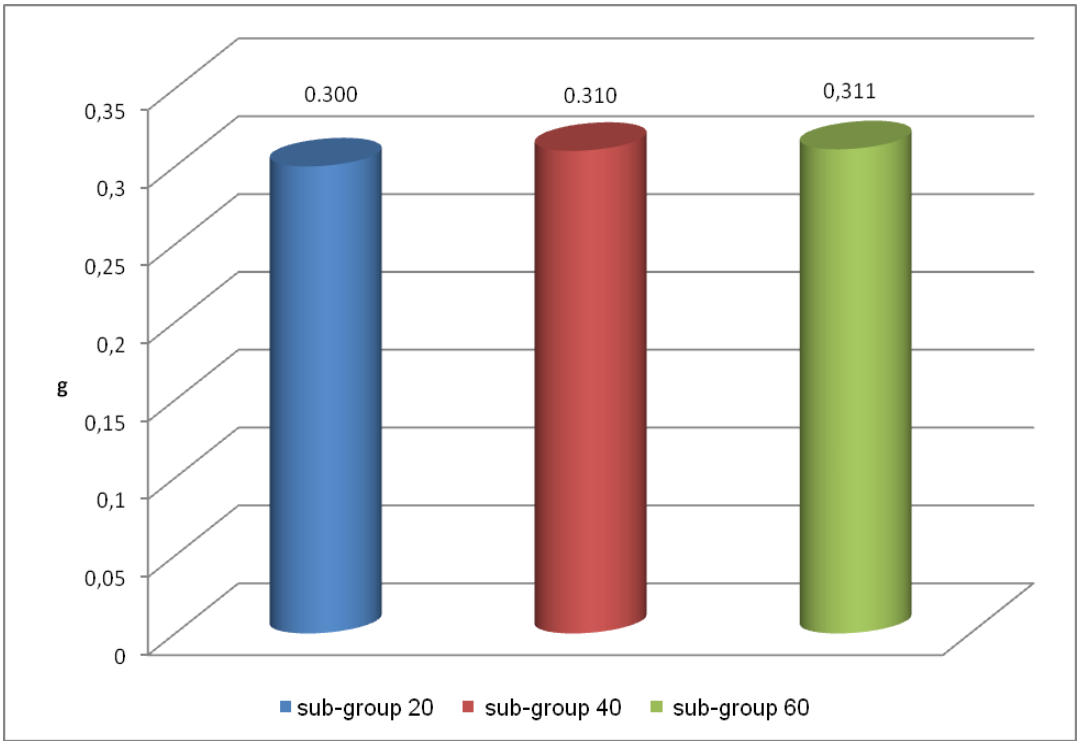
The average quantity of produced royal jelly per cell is 0,312 g, the least 0,003 g, at most 0,594 g.

The standard deviation of the percentage of produced royal jelly per cell is 0,086 g, and the varying ratio is 27,564%.

Influence of the factor presence of queen on the quantity of produced royal jelly per cell is presented in the graph 3:



Influence of the factor number of introduced larvae on the quantity of produced royal jelly per cell is presented in the graph 4:



4. Conclusions

Highest acceptance percentage and quantity of royal jelly per cell was obtained in the breeding colonies with 60 larvae introduced, lower in 40 and the lowest in the breeding colonies with introduced 20 larvae for royal jelly production.

Presence of queen bee in the breeding colonies is significant for the royal jelly production, and has an influence on obtaining higher acceptance percentage, as well as quantity of royal jelly per cell.

Presence of open brood and the pheromones produced in the queen right breeding colonies has an influence on the increasing the acceptance percentage of introduced larvae for royal jelly production, as well as the quantity of royal jelly production per cell.

The acceptance percentage of the introduced larvae for royal jelly production in all three production cycles was higher in the second production year.

Climate and harvesting conditions has a significant influence on the acceptance percentage of introduced larvae, as well as the quantity of royal jelly per cell.

For commercial royal jelly production, queen right breeding colonies with introduced 60 larvae are recommended.