

**SPRING DEVELOPMENT OF BEE COLONIES IN THE AGRO-ECOLOGICAL  
CONDITIONS OF THE WESTERN BOSNIA AND HERZEGOVINA**

Mica MLADENOVIC, Todor VULIC, Milovan VELICKOVIC, Miloš BAUK, Cedo  
OPARNICA, Radivoje MAKSIMOVIC

University in Belgrade, Faculty of Agriculture, Serbia  
\*(Corresponding author: mica.mladenovic@gmail.com)

**Abstract**

The aim of this study was to investigate the effect of fruit flow on commercial beekeeping using several pastures in western Bosnia and Herzegovina (BH) moving bees to different altitudes and different honey plants.

The experiment was carried out on the half-stationary apiary of Rade Bauk near by Drvar on the 460 m of height above sea level. The aim of the paper was to examine influence of the fruit pasture on commercial beekeeping using a few pastures in west BH by moving bees to different heights above sea level and to different melliferous plants. Bees spend winter in Drvar where the apiary is located in winter where they use fruit-developing pasture, and in Rore at 950 m above sea level bees use meadow and heather pasture, and in autumn bees are moved again to Drvar in the winter station. All colonies were carefully examined, prepared for wintering, and meteorological parameters are carefully analyzed including critical points for bees.

Bee colonies, which were prepared for winter with plenty of pollen were stable wintered and developed in the spring faster, regardless of the input of pollen from early blossoming plant species. Fruit pasture is irreplaceable developing pasture with a big influence on development of brood nest as well as quantity of honey in the next bee pasture. Bee colonies can take advantage of meadow and heather pasture if we continue stimulated feeding and introduction of two-queen way of beekeeping.

**Key words:** bee colonies, spring development, brood

**Introduction**

Beekeeping is a specific agricultural branch in Bosnia and Herzegovina where Domestic Carnica is bred (*Apis mellifera carnica* Poll.).

In order to exploit bee colonies in the best possible way in production of direct products (honey, royal jelly, pollen, wax, propolis, bee venom), also for pollination purposes, it is necessary to develop them by adequate apitechnic measures to their maximum and also make the best possible use of them. Apart from the timely preparation of bees for wintering, it is necessary to provide optimal spring development by different apitechnic measures (Bel i et al., 1985). Early spring development is of the crucial importance especially for exploitation a few main bee pastures which are recently more demanding for western parts of Bosnia and Herzegovina.

Spring development is a specific period for both honey bees, and also for each beekeeper because at that time the most important stimulative measures are usually done for strengthening bee colonies. Most attention is paid on bee queens stimulation in order to lay more eggs because from that brood bees, who take part in the exploitation of almost all main pastures in western Bosnia and Herzegovina, are developed. For that purpose it is necessary to have considerable amount of honey, and intake of fresh nectar and pollen as well (Sahinler, 2003). In the beginning of spring development it is usual that the surface of honey

and pollen on combs is reduced because of the stronger nutrition of bees and brood, but with inflow of the fresh nectar and pollen, the balance is made between brood and food reserves (Kulin evi , 2009; Mladenovi et al., 1999). Because of that it is very important to define critical points for stimulation of bee colonies and right intervention with sugar-honey cakes, sugar syrup or crystal sugar. Supplementary feeding with honey is avoided, not only because of the economic reasons, but also because of the danger to spread some bee diseases (Todorovi et al.,1983; Tosi et al., 2012).

At big apiaries a number of apitechnic measures are simplified and they are done serially, not to go into details for each bee colony (Crailsheim, 2010; Dietz et al., 1975; Kaftanoglu ,2007). Because of that it is important to make decision and expand brood chamber, or honey chamber if necessary, or stimulate a bee queen and bees to be more active, prevent a brood cold, do water supply, etc by visual symptoms of bees at the entrance and quick examination of brood chambers (Mladenovi et al., 1996, 1998, 2002). With LR bee hives it is usual to work with chambers as a working unit and all expanding or contracting are done by adding or taking away chambers.

Specific conditions of keeping bees in Bosnia and Herzegovina with specific melliferous plants from blossoming of *hazel*, *cornel*, *stone-fruit* and *apple fruit*, *broom*, *sage*, *acacia*, different *meadow melliferous* plants till heath, give possibilities for good spring development of colonies but also extracting of honey surplus and other bee products (Bertazzini et al., 2010). Because of that spring development is a big challenge for producers, as well as for scientists in order to define the best apitechnic measures regarding biological development of colonies.

### Materials and methods

Experiment was carried out in the apiary with 350 bee hives belonging to a beekeeper Rade Bauk in Drvar at 460 m above the sea level. In springs 2010 and 2011 apiary used *fruit pasture*, and in the first half of May it was moved to the village of Pope which is situated 30 km far from Drvar, towards Glamoc, at 950 m above the sea level. At this location bees used *meadow* and *heather pasture*.



Picture 1. Winter apiary in Drvar

Bee colonies are kept in LR – Langstroth-Rut ten-frame bee hives. This hive is most-widely used in the world, and the biggest advantage of this hive is that brood nest and honey

chambers are easily broaden or narrowed by adding or taking away chambers. Carniola bees are used in bee hives at this apiary (*Apis mellifera carnica* Poll.). Main characteristics are grey rings covered with whitish hairs. In spring it develops fast till its strength, and because of that it gets the instinct to swarm naturally. On the combs it is tranquil, mild temperament, it also fights for its brood well, it is not disposed to robbery, it produces small quantity of propolis. It also winters well even in bad weather conditions. It has the biggest capacity of the honey sac (0.02 to 0.04 mm<sup>3</sup>) and the longest tongue (6.5 to 8.2 mm, *in vivo*).

Bee colonies were examined in February 2010/2011, when we found out the number bee ways covered by bees, food quantity they have and we started stimulation by adding bee cakes (1kg) with nozucid.

The second examination was done at the end of March 2010/11. when we found out, apart from the previous information, brood surface and quantity of pollen in bee colonies.

The third examination was done at the end of April 2010/2011. when the surfaces of brood, honey and pollen were identified. During this examination at well-developed colonies we rotated brood chamber for 180°, changed position of brood chambers and chambers below brood chambers, one more bee cake (1 kg) ‘stimular’ was added to each colony.

The fourth examination was done on the 10<sup>th</sup> May 2010/2011. when the surfaces of brood, honey and pollen were defined. One chamber was added to all colonies that fulfilled the space inside bee hives.

All collected data was recorded, statistically processed and later discussed.

### Results and discussion

#### Analysis of brood surface

Table 1. Analysis of the brood surface shown in dm<sup>2</sup>

Date	H I V E S										Middle value
	16	73	42	117	28	55	92	84	107	191	
<b>03.2010/11</b>	55	57	66	32	30	67	24	31	59	41	<b>46,2</b>
<b>04.2010/11</b>	92	108	106	116	98	103	72	74	83	99	<b>95,1</b>
<b>05.2010/11</b>	110	112	118	134	140	124	88	102	117	132	<b>117,7</b>
<b>Difference</b>	55	55	52	102	110	57	64	71	58	91	<b>71,5</b>

Based on the data from the Table 1. it is seen that the brood surface from the examination carried out in March 2010/11. until the examination carried out in May 2010/11 was constantly increasing. Brood surface in 45 days increased for 71.5 dm<sup>2</sup>, what showed that colonies that were well-prepared for wintering with adequate food storage to faster development in spring.

For most observed colonies more quantities of honey and pollen were left in autumn, and frames with honey were added to colonies that showed the lack of food during the first spring examination and stimulation with sugar-honey cakes started.

Good meteorological conditions influence fast spring development apart from other factors. In both examined years there were no critical temperatures which would prevent bees to keep optimal temperature of brood, so there was no discontinuation in development. Favourable temperatures were also present during blossoming of cornel. There was a plenty of cornel in the area of Drvar. It usually blossoms around 20th March, which classifies it in the main stimulative early nectar pasture. A special stimulation of the bee brood happens in the period of blossoming of stone-fruit as well as apple fruits.

In 30 days of spring development in the period from the end of March till the end of April brood surface doubled (from 46,2 to 95,1 dm<sup>2</sup> , and for the next 15 days brood

development also increased for 22 dm<sup>2</sup>. In some colonies (beehive 28) that development increased for 30 dm<sup>2</sup> in March, to 98 dm<sup>2</sup> in April, and to 140 dm<sup>2</sup> of brood in May.

#### Analysis of honey surface

Table 2. Analysis of honey surface

Date	HIVES										Middle value
	16	73	42	117	28	55	92	84	107	191	
<b>03.2010/11</b>	24	98	104	32	112	96	56	80	24	96	<b>72,2</b>
<b>04.2010/11</b>	80	80	96	72	82	64	64	88	64	80	<b>77,0</b>
<b>05.2010/11</b>	88	88	120	104	120	98	80	88	72	92	<b>95,0</b>
<b>Difference</b>	<i>64</i>	<i>-10</i>	<i>16</i>	<i>72</i>	<i>8</i>	<i>2</i>	<i>24</i>	<i>8</i>	<i>48</i>	<i>-4</i>	<b>22,8</b>

Based on the data from the Table 2. it is obvious that surface of honey between first two examinations there was an insignificant increase ( 4,8 dm<sup>2</sup>), it means that nectar intake was bigger than honey consumption for the brood nutrition in that period. *Cornel* and *dzanarika*, a kind of a stone-fruit are most responsible for this increase. Honey surface between the second and the third examination increased for 18 dm<sup>2</sup>. The total growth of honey surface between the first and last examination was 22,8 dm<sup>2</sup>.

It is usual for this area that the honey surface was reduced until the blossoming of fruit, and during fruit pasture it had an insignificant increase or stayed at the same level. Apart from the increase of the honey consumption for the brood nutrition, this happens also because of the changeable meteorological conditions and insufficient exploitation of nectar and pollen pasture. Because of that two enriched bee cakes with vitamins and growth gormons were added.

#### Analysis of pollen surface

Table 3. Analysis of pollen surface

Date	HIVES										Middle Value
	16	73	42	117	28	55	92	84	107	191	
<b>03.2010/11</b>	18	27	26	25	27	25	18	14	18	24	<b>22,2</b>
<b>04.2010/11</b>	24	36	30	27	18	12	8	9	11	16	<b>19,1</b>
<b>05.2010/11</b>	32	41	33	27	41	31	22	24	21	31	<b>30,3</b>
<b>Difference</b>	<i>14</i>	<i>14</i>	<i>7</i>	<i>2</i>	<i>14</i>	<i>6</i>	<i>4</i>	<i>10</i>	<i>3</i>	<i>7</i>	<b>8,1</b>

Taking into consideration the data from the Table 3. it is obvious that between first two examinations surface of pollen was reduced for 3.1 dm<sup>2</sup>. This reduction of the pollen surface is the result of the intensive growth of the brood for which nutrition it is necessary to use large amounts of pollen. Between the second and the third examination there was a significant growth of the pollen surface which was 11.2 dm<sup>2</sup> although in that period there was an intensive growth of the brood surface. Fruit pasture had the biggest impact on this growth which gave, apart from nectar, a lot of the pollen powder.

Comparing data from the first and the third examination, it is seen that the surface of brood was increased from 8.1 dm<sup>2</sup>.

Based on the data from the previous tables it can be concluded that bee colonies which had bigger reserves of pollen in March, with the condition that they also had enough honey, had more intensive spring development than the bee colonies that had less pollen and honey.

### Conclusion

Based on the experimental work on spring development of bee colonies in the agroecological conditions of west Bosnia and Herzegovina, it can be concluded:

- Bee colonies which were wintered in autumn with more bee ways, bigger quantities of honey and pollen, had more intensive spring development than the bee colonies which were weaker.
- Brood development for 40 days of spring development ranged from 30 dm<sup>2</sup> to 140 dm<sup>2</sup> what was of crucial importance for exploiting of meadow and heather pasture.
- Surface of honey in the examination period increased in average for 22.8 dm<sup>2</sup>, which had a stimulating effect on preparation of colonies for the next meadow pasture.
- Surface of pollen was reduced in the early spring, regardless the increased intake, from 22.2 dm<sup>2</sup> to 19.1 dm<sup>2</sup>, but blocking the brood it was increased to 30.3 dm<sup>2</sup> in the second phase of development.
- In this region meadow pasture is the first main pasture from which honey harvest is expected, so beekeepers should feed bees stimulating them and to perform double-queen beekeeping, preparing colonies for this pasture.

### References

- Bel i J, Katalini J, Loc D, Lon arevi S, Peradin L, Sulimanovi , Tomašec I, Šimi F, (1985): Beekeeping, Knowledge Printing Institute, Zagreb.
- Bertazzini M., Medrzycki P., Bortolotti Laura, Maistrello Lara, Forlani G. ( 2010): "Amino acid content and nectar preference in forager honeybees", 4<sup>th</sup> European Conference of Apidology, Ankara, 143.
- Crailsheim K. (2010): "The impact of nutritional protein on the honey bee – a review", 4<sup>th</sup> European Conference of Apidology, Ankara, 81.
- Dietz A., Stevenson H. R. (1975): "The effect of long-term storage on the nutritive value of pollen for brood rearing of honey bees", Amer. Bee J. 115; 476-477; 482.
- Kaftanoglu O. (2007): "Effect of Feeding Intervals on the Development of Honey Bees reared in vitro", The XXXX<sup>th</sup> Apimondia International Apicultural Congress, Melbourne.
- Kulin evi J. (2009): Beekeeping, Partenon, Belgrade
- Mladenovi M., Mladjan V., Dugali -Vrnci Nada (1999): "Effect of a vitamin-mineral preparation on development and productivity of bee colonies", Acta veterinaria, 49, No 2-3, 177-184.
- Mladenovi M., Gaji D., Jevti G., Mirjani G. (2002): " The effect of adding a enriched syrup on the development of bee colonies ", Biotechnology in Animal Husbandry, XV Inovations in Animal Husbandry, Belgrade.
- Mladenovi M. (1998): " Influence of Oligovit and brewer's yeast addition on bee colonies production ", Contemporary Agriculture, 1-2, 209-212, Novi Sad.
- Mladenovi M., Živi Suzana, (1996): " Use of sugary honey dough and yeast in the diet of bees ", Biotechnology in Animal Husbandry, 155-160, Beograd.
- Sahinler N., Sahin A., Kaya S., (2003): "The effect of supplementary feeding on honeybee colony performance", The XXXVIII<sup>th</sup> Int. Apicultural Congress of Apimondia, Ljubljana, 158.
- Todorovi V., Todorovi D. (1983): Practical beekeeping, Nolit, Belgrade.

Tosi S., Medrzycki P., Bergamini D., Costa Cecilia, (2012): "Does the pollen available to the colony influence the health of the bees?", COLOSS Workshop "Honey bee nutrition", Bled, 31.

<http://grupa.pcela.rs>,

<http://spos.info/forum>,

<http://www.fhmzbih.gov.ba>, accessed on June 20th, 2011.

Scoring of Bosnia and Herzegovina in the Index began in 1998. Since then, the country has made slow but steady progress. Its economy has been designated moderately free for the past four years. GDP growth during that period has also been solid.Â Bosnian Serb nationalist leader Milorad Dodik and Sefik Dzaferovic of the large Muslim Bosniak party won the Serb and Bosniak seats in Bosniaâ€™s triumvirate presidency in October 2018 elections. The slow pace of reform has delayed accession to the EU. The economy relies heavily on exports of metals, energy, textiles, and furniture as well as on remittances, foreign aid, and Chinese infrastructure investment, particularly in the energy sector. Reproduction of bee colonies Natural swarming of bees. In natural conditions, the increase in the number of families occurs by digestion. Swarming is a manifestation of the instinct of reproduction of a bee family. The swarming is as follows. Hibernation of bees Properly organized bee hibernation is one of the most important tasks in beekeeping.Â Exhibition of bees in the spring from the winter hut The time of the spring exhibition of bees at will depends on their behavior and weather. In greenhouses, reserve bee colonies usually have extremely small stocks of Perga or do not have them at all. Bee baby The young, just hatched chicken â€” the creature is in many respects underdeveloped, but in general it is very similar to the parents. Bosnia and Herzegovina has a bicameral legislature and a three-member Presidency composed of a member of each major ethnic group. However, the central government's power is highly limited, as the country is largely decentralized and comprises two autonomous entities: the Federation of Bosnia and Herzegovina and Republika Srpska, with a third region, the BrÃko District, governed under local government.Â The Early Slavs raided the Western Balkans, including Bosnia, in the 6th and early 7th century (amid the Migration Period), and were composed of small tribal units drawn from a single Slavic confederation known to the Byzantines as the Sclaveni (whilst the related Antes, roughly speaking, colonized the eastern portions of the Balkans).[26][27] Tribes recorded.