

THE INFLUENCE OF THE QUANTITY OF HONEYBEES AND HONEY RESERVES ON WINTERING OF HONEYBEE COLONIES¹

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Abstract: The colonies were, in the course of the autumn examination, according to the quantity of honeybees and honey reserves, divided into three groups: weak, medium strong and strong. Weak colonies had 5 frames occupied by bees and 3 frames with honey. Medium strong colonies had 8 frames occupied by bees and 5 frames with honey, while strong ones had 11 frames occupied by bees and 7 frames with honey. Each group comprised 5 colonies. The colonies were in ten frame LR-beehives. In our two-year long investigation we have monitored the influence of the quantity of honeybees and honey reserves on wintering and the state of colony in spring examination. In the first year, regarding honeybees, strong colonies had wintered best, regarding brood and pollen the best were medium strong colonies while weak colonies were most economical regarding the spending of honey reserves. Best wintering in the second year regarding bees, brood and pollen had a medium strong colonies while weak colonies were most economical in honey spending. Strong colonies, in both years of investigation, had the greatest quantity of bees, broods and honey in spring, while medium strong colonies had the greatest quantity of pollen. During spring examination in the second year strong colonies had 47.1 % more broods, 59.8% more honey 34.7% more honeybees than medium strong colonies.

Key words: honey bee, wintering, colony strength, honey reserves

Introduction

From the beginning of the economical beekeeping, that is, from the moment when a man had a crucial role in the life and work of a honeybee, beekeepers had always been approached with problems of unplanned losses of colony in winter. Even until now this problem has not been more radically alleviated. In order that bee colony wintered properly it is very important to have a good queen bee in autumn together with corresponding reserves of honey and pollen and to have a colony free from diseases and protected from the extreme environment conditions. Regarding maintaining of honeybee colonies in our agroecological conditions it seems that the most critical periods are both a period of wintering and early spring development (Nedić *et al.*, 2003). In order that one colony should overcome these two critical periods in a normal manner it is necessary to start wintering with 15-25000 honeybees. The colony shall have regularly performed wintering if its bee population covers 10-15 frames (Furgala, 1975). It is also very important that colony in autumn should be provided with 15-20 kg of well-arranged honey (Kulinčević, 1999). Besides the fact that the strength of a colony depends on genetic potential of a queen bee, it depends also on the quality and quantity of food that is stored during wintering. Honeybee colonies that start wintering with 20 kg honey have most favourable spring development while colonies with 5 kg honey are lagging behind in spring (Mladenović *et al.*, 2002). On the presence of sufficient quantities of food depends primarily the quantity of excreted brood-food in brood-food glands of nursing bees (Taranov, 1986). On the quantity and quality of food depends the capacity of queen bee to lay eggs what is in a positive correlation with the number of bees per colony and its strength (Mladenović, 1992; Mladenović *et al.*, 1999). Thus, the objective of this paper was to determine the optimal strength of colony and quantity of food necessary for normal wintering of honeybee colony. At the same time it was important to examine the way in which colonies of different strength and with different reserves of food lose their honeybees during wintering, how rapidly they regenerate in spring and how rationally they spend their food.

Material and method

The trial was conducted during the wintering in 2001/2002 and 2002/2003 at the stationary beehive of the Centre for Forage Crops in Kruševac. Ten-frame LR-colonies were used in the trial. In the course of

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autumn examination the colonies were divided, according to their quantity of bees and honey supplies, into the weak, medium strong and strong colonies. Weak colonies had approximately 5 frames occupied by bees and 3 frames with honey (7-9 kg). Medium strong colonies had about 8 frames occupied by bees and 5 frames (13-15 kg) with honey, and strong colonies had 11 frames with bees and 7 frames (17-20 kg) with honey. Each group comprised 5 colonies. The autumn examination was performed in early September, and spring examination in late March. During each examination we have determined the area of frames occupied by bees, brood, honey and pollen in 1/10 frame. All values were subsequently collected and expressed as a number of frames per colony. In order to determine the tempo according to which the strength of colony and food reserves during wintering changed for all investigated characteristics, we have calculated the ratio between values in spring and those obtained by autumn examination. During wintering all colonies were supplemented with three kilos of sugar flour (3 sugar candies). First sugar candy was supplemented by the end of October, second by the end of January, and third by the end of February. The first two candies were energy ones (sugar), while the third was enriched with vitamin complex. At the beginning of trial in all colonies there were present queen bees from 2001. All colonies were regularly treated against *Varoa destructor*.

Results and discussion

On closer inspection of the first year of investigation we can observe that in spring examination the strongest were the strong colonies, and they had the greatest number of bees, broods and honey. Medium strong colonies had greatest pollen, while weak colonies were the least in all investigated characteristics (Table 1). The ratio of bees between observed groups of colonies was similar to that observed in autumn. The quantity of broods differed considerably since the medium strong and strong colonies had much more broods than weak ones. There was also a difference between medium strong and strong colonies. Strong colonies had 33.1% more bees than medium strong (5% more than in autumn examination), and these colonies also had 25.5% more broods.

Table 1. Characteristics of colonies during autumn and spring examinations in 2001 and 2002

Autumn					
	Honeybees	Brood	Honey	Pollen	Dead colonies
Weak colonies	5,08	1,20	3,56	0,26	
Medium strong colonies	7,96	0,78	5,34	0,38	
Strong colonies	11,76	0,94	7,34	0,64	
\bar{X}					
Spring					
	Honeybees	Brood	Honey	Pollen	Dead colonies
Weak colonies	2,38	1,04	1,36	0,40	1
Medium strong colonies	4,72	2,40	2,00	1,08	-
Strong colonies	7,06	3,22	2,28	1,05	-
\bar{X}	4,72	2,22	1,88	0,84	0,3

During the first three years, from all examined colonies, only one suffered damages and it was in the group belonging to weak colonies. The cause of their damage was greed for food. The best wintering had strong colonies and they had the best bees:brood ratio between spring and autumn examination. The most economical in spending food were weak colonies although we can observe that all colonies were spending food in a considerable degree, especially strong ones. Medium strong colonies, besides the fact that they collected the greatest quantity of pollen in spring also had the most favourable ratio of pollen between two examinations (Table 2).

Medium strong and strong colonies did not differ significantly regarding mutual relationship of bees and broods in two examinations but weak colonies differed significantly thereof. Medium strong and strong colonies in comparison with weak colonies had more broods in spring (2.5 and 3 times more) while the ratio between two trials was even more advantageous in favour of these two groups of colonies (3 and 4 times).

The differences of colonies regarding the economy of spending honey were not significant, while the medium strong colonies significantly differed in the economy of using of pollen.

Table 2. Colonies characteristics relations between spring and autumn examinations

	Honeybees	Brood	Honey	Pollen
Weak colonies	0,47	0,87	0,38	1,54
Medium strong colonies	0,59	3,08	0,37	2,84
Strong colonies	0,60	3,42	0,31	1,64
\bar{X}	0,55	2,81	0,35	2,01
Lsd 005	0,178	1,278	0,334	1,118
001	0,298	1,392	0,457	1,364

In the spring of the second year the strong colonies were again the strongest ones with the greatest number of bees, broods, honey and pollen. Medium strong colonies followed immediately after them while the weakest were the weak colonies (Table 3). Mutual relationship of colonies in spring, for all parameters except for the level of brood, remained the same as in the autumn examination. Weak colonies, which in the autumn had a great number of broods, in this period, were behind considerably in comparison with other groups. During spring examination in the second year strong colonies had 34.7% more bees, 47.1 % more broods and 59.8% more honey than medium strong colonies.

Table 3. Characteristics of colonies during autumn and spring examinations

Autumn					
	Honeybees	Brood	Honey	Pollen	Dead colonies
Weak colonies	5,56	2,52	2,76	0,18	
Medium strong colonies	7,92	2,08	4,82	0,32	
Strong colonies	11,14	3,96	6,44	0,54	
\bar{X}					
Spring					
	Honeybees	Brood	Honey	Pollen	Dead colonies
Weak colonies	2,76	0,92	2,72	0,38	2
Medium strong colonies	4,32	1,54	3,38	0,66	1
Strong colonies	6,02	2,56	5,40	0,74	-
\bar{X}	4,37	1,67	3,83	0,59	1,0

In the second year, from the group of weak colonies, two colonies suffered damage (greed for food), and from the group of medium strong colonies there was one colony, which suffered damage (food reserves, problem with honeybees). When the losses and regeneration of honeybees is in question a medium strong and strong colonies were equally successful while the weak ones fell behind, but this difference was not statistically significant (Table 4). Medium strong colonies regenerated brood and pollen reserves most rapidly while weak colonies were most economical in food spending.

Table 4. Colonies characteristics relations between spring and autumn examinations

	Honeybees	Brood	Honey	Pollen
Weak colonies	0,50	0,37	0,99	2,11
Medium strong colonies	0,55	0,74	0,70	2,06
Strong colonies	0,54	0,65	0,77	1,30
\bar{X}	0,52	0,59	0,82	1,82
Lsd 005	0,135	0,377	0,298	0,988
001	0,151	0,498	0,356	1,103

As regards the wintering of trial colonies the first year was considerably more successful since only one colony was destroyed compare to the second year when three colonies were destroyed. Besides that,

number of bees, broods and pollen as well as mutual relationship of characteristics of colonies between two trials was more favourable in the first year. This can in the first place be attributed to a great number of brood that colonies had during autumn examination in the second year. Such a late brood did not give quality winter bees. Already living bees have spent themselves while they were nursing the brood so the colonies wintered badly and in spring they considerably fell behind in strength and were slow in honeybees regenerating. In the spring of the second year there was much more honey and bees spent it more economically in comparison with the first year.

Conclusion

According to the results, following conclusions can be made:

- There is a significant effect of strength and food quantity on honeybee colonies wintering.
- Strong colonies had best wintering, had no losses during wintering and showed best results for almost all examined characteristics. Strong colonies had in both examined years retained their superiority for the quantity of bees and broods in relation to other two groups of honeybee colonies.
- Medium strong colonies were most economical in using and collecting of pollen and also showed satisfying dynamics in development of brood and regeneration of bees.
- Weak colonies did not show good results during wintering although they proved to be economical in food spending.
- In our agroecological conditions only strong colonies which have more than 10 frames occupied by honeybees and more than 6 frames of honey in autumn can have normal wintering and can preserve satisfying strength in spring.
- Medium strong colonies (7 frames occupied by bees and 5 frames with honey) proved economical during wintering, but did not show enough strength in spring.
- Weak colonies (5 frames occupied by bees and 3 frames with honey) should not be left for wintering.

UTICAJ KOLIČINE PČELA I ZALIHE MEDA NA ZIMOVANJE DRUŠTAVA MEDONOSNE PČELE

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Rezime

Društva su tokom jesenjeg pregleda, na osnovu količine pčela i zaliha meda, podeljena u tri grupe (slaba, srednje jaka i jaka). Slaba društva su imala oko 5 ramova zaposnutih pčelama i 3 rama sa medom. Srednje jaka su imala 8 ramova pčela i 5 ramova sa medom, a jaka društva su imala 11 ramova sa pčelama i 7 ramova meda. U svakoj grupi se nalazilo po 5 društava. Društva su se nalazila u desetoranim LR-košnicama. U dvogodišnjem istraživanju praćen je uticaj navedenih parametara na prezimljavanje i stanje društva. U prvoj godini kada su u pitanju pčele najbolje su zimovala jaka društva, kada je u pitanju leglo i polen najbolja su bila srednje jaka društva, dok su najekonomičnija u potrošnji meda bila slaba društva. Najbolje prezimljavanje u drugoj godini za pčele, leglo i polen imala su srednje jaka društva dok su slaba društva bila najekonomičnija u potrošnji meda. Jaka društva u obe godine istraživanja su u proleće imala najviše pčela, legla i meda, dok su najviše polena imala srednje jaka društva. Tokom prolećnog pregleda u drugoj godini jaka društva su od srednje jakih imala za 47,1 % više legla, 59,8% više meda i 34,7% više pčela.

Ključne reči: medonosna pčela, zimovanje pčela, snaga društva, zalihe meda

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