Praca oryginalna *Original paper*

Effect of the uncapping of combs with winter food stores in early spring on the amount of brood reared in honey bee colonies

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Summary

In many areas in Central Europe, rape culture is one of the main nectar flows for bees. The natural spring development of honey bee colonies is too late for the full utilization of nectar plants in May. It is recommended to use spring managements, which increase the amount of brood, reared in March and April, to obtain as many foragers as possible for spring flows. According to many beekeepers, uncapping of combs with winter food is a very good method of accelerating the development of bee colonies in spring. The purpose of this study was to investigate whether the uncapping of winter food affects the amount of brood reared. The research was conducted in April 2007 and 2009 in south-eastern Poland. In total, 54 honey bee colonies were investigated. Winter food was uncapped in half of the colonies, and in the other half no management was used. The comparison of development in both groups was based the measurements of brood areas. It was found that the uncapping of combs with winter food in early spring had no significant effect on the amount of brood reared in honey bee colonies.

Keywords: beekeeping, honey bee, brood rearing, spring development, uncapping of winter food

The amount of brood reared in honey bee colonies before the honey flow should be as high as possible to ensure the greatest possible number of workers during the flow. Honey production depends on the fertility of queens. The more eggs they lay, the greater the honey crops (13). In research conducted by Mattila and Otis (11) and Roman and Dawidowicz (16), most honey in the season was obtained from colonies which had the largest amount of brood in spring. Bhusal and Thapa (1) also found a significant positive correlation between honey production and the amount of brood reared. According to Szabo and Lefkovitch (23), honey production is significantly positively correlated with the number of brood cells only in the first half of the season. Woyke (24) also found a high positive correlation between the amount of brood and honey production in spring, and a low correlation in the summer. A recent study shows a positive correlation also between the size of bee population and honey production under different environmental conditions (8). Therefore, honey production can be increased by applying methods stimulating bees to rear brood in early spring. Many authors have investigated different methods of accelerating the development of honey bee colonies (2-7, 9 10, 12, 15, 17, 19-22). According to many beekeepers, the uncapping of honey combs with winter food contributes to increased brood rearing. In a research by Roman and Dawidowicz (16), colonies in which combs were uncapped had, at the end of April, three times as much brood as the control colonies. Queens in colonies with uncapped combs laid 200 more eggs per day in spring, compared to colonies in which honey stores were not uncapped (14). According to Zmarlicki and Marcinkowski (25), the uncapping of combs has no significant influence on the amount of brood reared in early spring.

The purpose of this study was to investigate the influence of the uncapping of honey combs of winter stores on the spring development of bee colonies.

Material and methods

The experiment was conducted in south-eastern Poland in April 2007 and 2009. Altogether, 54 *Apis mellifera ligustica* bee colonies in Dadant hives were observed in this research. All queens were one year old, came from one reproductive queen, and were naturally mated. The colonies were divided into two groups to ensure that the average number of combs covered by bees (population size) was the same

in both groups. In one (Control) group no management was performed, while in the other (Uncapping) group, honey combs with winter store were uncapped. In the Uncapping group, stores on five brood combs, ca. 1 dm^2 on each side, were uncapped. If there were fewer brood combs in a colony or if they contained no honey stores, combs located near the brood were uncapped so that the uncapped stores occupied the area of ca. 10 dm^2. The amount of brood in both groups was compared on the basis of the measurement of the brood area, three weeks after the uncapping. The method of measuring two ellipse diameters was applied (17).

One- or two-way ANOVA was applied for statistical analysis. Calculations were performed with the use of the SPSS 21 software.

Results and discussion

One-way ANOVA did not show a significant effect of the uncapping of combs with winter food stores on the amount of brood reared in 2007 ($F_{1,23} = 0.471$, $P = 0.5$). Colonies in the Uncapping group reared 8% more brood than in the Control group (Tab. 1).

Tab. 1. Area of brood (dm^2) in each group in 2007

Group	Number of colonies	Min-Max	Mean ± se
Control	12	27.7-86.8	62.2 ± 4.7
Uncapping	12	33.5-94.9	67.2 ± 5.5
Overall	24	27.7-94.9	64.7 ± 3.6

Explanation: Significant differences between the means were not found.

Tab. 2. Area of brood (dm^2) in each group in 2009

Group	Number of colonies	Min-Max	Mean ± se
Control	15	69.0-100.0	81.2 ± 2.7
Uncapping	15	50.8-99.1	76.3 ± 3.2
Overall	30	50.8-100.0	78.8 ± 2.1

Explanation: As in Tab 1.

Tab. 3. Area of brood (dm^2) in each group (two years)

Group	Number of colonies	Min-Max	Mean ± se
Control	27	27.7-100.0	72.8 ± 3.1
Uncapping	27	33.5-99.1	72.3 ± 3.1
Overall	54	27.7-100.0	72.5 ± 2.2

Explanation: As in Tab 1.

Tab. 4. Area of brood (dm^2) in 2007 and 2009

Year	Number of colonies	Min-Max	Mean ± se
2007	24	27.7-94.9	64.7 ± 3.6[a]
2009	30	50.8-100.0	78.8 ± 2.1[b]
Overall	54	27.7-100.0	72.5 ± 2.2

Explanation: Different letters indicate significant differences between the means ($P < 0.05$)

One-way ANOVA did not show a significant effect of the uncapping of combs with winter food stores on the amount of brood reared in 2009 ($F_{1,29} = 1.342$, $P = 0.257$). Colonies in the Uncapping group reared 6% less brood than in the Control group (Tab. 2).

Two-way ANOVA did not show a significant effect of the uncapping of combs with winter food stores on the amount of brood reared ($F_{1, 53} \approx 0.000$, $P = 0.989$). However, a significant effect of the year of experiment was observed ($F_{1, 53} = 12.310$, $P = 0.001$). Interaction between the two factors was not found to be significant ($F_{1,53} = 1.517$, $p = 0.224$). In total, colonies in the Uncapping group reared 1% less brood than in the Control group (Tab. 3). All colonies in 2009 reared 22% more brood than in 2007 (Tab. 4).

The uncapping of combs with winter store had no significant influence on the spring development of colonies, which confirms the results of the study by Zmarlicki and Marcinkowski (25). Our results do not confirm the conventional wisdom and the results of experiments conducted by Ostrowska (14) and by Roman and Dawidowicz (16). The results obtained in this experiment can be explained by the fact that no additional food was provided to bees when the winter store was uncapped. However, under other conditions, this method of stimulating the development of colonies may bring positive results. The higher amount of brood in 2009 is probably the result of more favorable environmental conditions.

The uncapping of honey combs with winter food stores in early spring does not significantly affect the amount of brood reared in honey bee colonies.

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