

## EFFECT OF EARLY SUPPLEMENTAL FEEDING HONEYBEE COLONIES WITH A SUBSTITUTE OF BEE BREAD MADE OF DRONE BROOD CANDY, GLUCOSE AND HONEY ON COLONY STRENGTH

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### S u m m a r y

The experiment was run in a stationary apiary, at Grabownice, the poviats of Brzozów, in the spring of 2004. The trial involved nineteen honeybee colonies divided into two groups:

group I - 10 honeybee colonies were fed candy mix made of drone pupae and powdered glucose,

group II - 9 colonies fed honey-and-sugar candy.

The development of colonies was assessed based on brood area measurements. The experiments furnished evidence that early spring feeding of honeybee colonies with a mix of drone brood and glucose raised brood number in the colonies but only when the bees were unable to forage for pollen. Later in the season, i.e. in April and in May feeding with candy not only failed to increase colony strength but had an inhibitory effect. Thus feeding that kind of bee bread substitute in April and May is unwarranted since at that time the bees can feed the brood with the food made of freshly harvested pollen and with bee bread made thereof.

**Keywords:** colony strength, drone brood, colony development.

### INTRODUCTION

Colony strength before the nectar flow is a critical factor behind honey yield. Of particular importance is to bring the colony up to a high strength early in the spring which allows an effective use of early flows nowadays prevailing in this country. A frequently used method to hasten colony development is to feed the colonies with bee bread (Maurizio 1950, Standifer 1967, Campana and Moeller 1977), candy or with other substances. Hayes (1984) and Loper and Berdel (1980) hold the opinion that pollen is an indispensable food to be given to honeybee colonies in the spring. According to them, with the absence of pollen honeybee colonies can be fed substitutes which stimulate egg-laying and maintain brood

rearing under less-than-optimum conditions. Hayes (1984) recommends soybean flour and yeast added to candy as the food to be given to colonies in the spring. Cook and Wilkinson (1986) believe that pollen substitute diets produce inconsistent results and not always stimulate egg-laying. Konopacka (1968) was also sceptical about the use of substitutes. She found that feeding soybean meal and yeast to honeybees failed to have a clear positive effect on colony development and performance. Likewise, Zmarlicki and Marcinkowski (1980) failed to find a clear effect of early spring feeding a hydrocarbon diet on the number of reared brood. Baryczko and Szymaś (2001) found a higher average degree of pharyngeal gland development in bees that

were fed bee bread. Likewise, they found fresh body weight to be higher by 8% in bees that were fed pollen from pollen loads. The rate of ingestion of food given to the bees increases with decreasing external temperature and with increasing temperature inside the hive (Łangowska and Szymaś 2001). The effect of early-spring cold spells on bee activity was found by Dustmann and Ohe (1988). Flight activity in the spring is positively correlated with temperature and restricted pollen supply as a result of low temperatures negatively affects the development of brood and of pharyngeal glands. Rogala and Szymaś (2001) determined the effect of non-protein diet on the content of amino acids in honeybee bodies. After two weeks on such a diet they found a lower content of essential amino acids in bee bodies as compared to that in one day-old bees. Szymaś and Przybył (1995) investigated how feeding with different pollen substitutes affected different tissues of the honeybee. They used potato protein, soybean meal, yeast, low-fat powdered milk, powdered chicken eggs, extruded maize and vitamin mix. They found the development of pharyngeal glands, fat body and ovaries to be similar to that of the bees that were fed bee bread. They also found those substitutes to be suitable for early-spring stimulation of colony development. An increase of the brood area in colonies that were supplemented with that substitute was by 90% higher than that in the non-supplemented controls whilst at the same time the supply of honey accumulated within three weeks was higher by 52%. Kazimierczak-Baryczko and Szymaś (2004) in their study found a beneficial effect of probiotic formulas (Biogen-N, Trilac) on the development of pharyngeal glands and of the fat body. Szymaś and Przybył (1996) in their study of the efficacy of feeding protein substitutes to

honeybees found an increase of the fat body in the bees that were fed potato protein substitute and fish protein hydrolysate. The fat body was most developed in the bees fed the latter substitute. The pharyngeal glands of substitute-fed bees were developed slightly poorer than in bee bread-fed controls (Szymaś and Przybył 1996). Drone brood-glucose mix was used in that study.

The objective of the study was to investigate the effect of early supplemental feeding of honeybee colonies with drone brood-glucose candy on colony strength expressed in terms of brood area.

## MATERIAL AND METHODS

The study was conducted in the spring of 2004 in a stationary apiary at Grabownice, the powiat of Brzozów, Podkarpackie voivodeship. The Carniolan queens used in the experiment were siblings; they were inseminated naturally by drones of unknown origin.

The experiment area was dominated by early and medium early nectar flows mainly from goat willow, other willow species as well as from maple, dandelion and sycamore.

The experiment was carried out in Wielkopolski type hives. Two colony groups of similar strength were formed:

- group I - 10 honeybee colonies were fed candy made of drone pupae and glucose,
- group II - 9 colonies fed honey-and-sugar candy.

The candy was made of three ingredients: drone brood (kept for over half a year in a freezer), powdered glucose and honey in a weight ratio of 2:1:0.5.

The candy was placed on the escape board and was replenished as the colonies consumed it. A single candy portion weighed 0.5 kg. It was in the form of a pat 1.5 cm thick wrapped in thin plastic sheet

and placed on the escape board. Honey and sugar candy was served in a similar fashion. The candy was replenished as the bees used it up. The rate of consumption per colony was 1.5 kg of candy.

Three weeks after the supplemental feeding was started brood area in each colony was measured. The first measurement was done on March 20, 2004. The next two measurements were done at 21-day intervals, on April 10, 2004 and on May 1, 2004. Brood area was measured using a modified ellipse area formula and expressed as square decimeters:

$$P = 0.7854 \times D \times d$$

where

P = ellipse area,  
D = the longer diameter,  
d = the shorter diameter.

Bonferroni test was used in statistical calculations performed using SPSS software.

## RESULTS

Following the first period of the diet, the colonies fed the cake enriched with protein and other drone brood-derived

substances showed an increase of brood area by 5 dm<sup>2</sup> as compared to the colonies that were fed non-protein candy (Fig. 1).

However, three weeks later, during the second measurement, the brood area in colonies fed drone brood candy was found to be smaller by 5 dm<sup>2</sup> than that of the control group being 31.38 dm<sup>2</sup>.

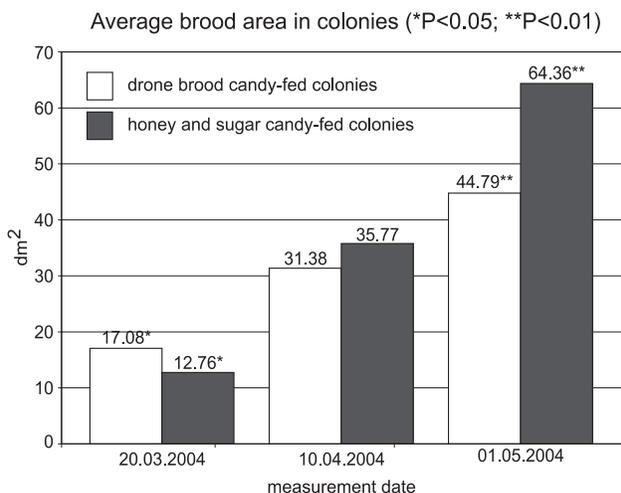
In the first study period i.e. from Feb. 28, 2004 to March 20, 2004 a greater brood area growth rate was found in colonies fed drone brood-enriched candy.

Conversely, during the next measurements made in April and in May a greater brood growth rate was found in control colonies.

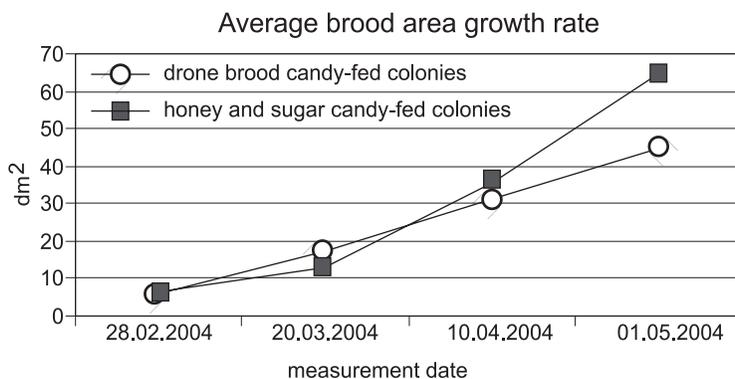
The data revealed that early supplemental feeding of colonies with candy enriched with drone brood-derived protein brought brood area. The brood area in test colonies was, on average, greater by 23% than that in control colonies. However, it was manifest only during the initial period of supplemental feeding when pollen was not as yet available.

Statistical analysis proved the difference to be significant.

Another three weeks passed, the control colonies showed brood area greater by



**Fig. 1.** During the final measurement on May 1, 2004 the increase of the brood area in the controls on that in the supplementally fed group was as much as fourfold



**Fig. 2.** The measurement data allowed the assessment of brood area growth rate

14% than that of supplementally fed colonies. However, the difference was not statistically valid. The tendency for the control colonies to show greater rate of brood area increase became more pronounced in May with test colonies showing 29% more brood than the colonies fed drone brood candy. That difference was highly significant.

Protein enriched candy, even when fed in small quantities, probably became a factor that promoted early egg-laying by the queens to a greater extent than feeding candy without protein supplement. When bee bread is in short supply in early spring feeder bees stimulated by candy use up all their supply of fat body and thus become capable of producing brood later on. The evidence is provided by the differences in the amount of brood between test colonies and control colonies, differences to a disadvantage of the former, during the 2<sup>nd</sup> and the 3<sup>rd</sup> brood count. Probably the bees of control colonies were more avid pollen gatherers in April and in May and fresh pollen and bee bread are known to be the superior source of protein for brood rearing. Protein enriched pollen discouraged pollen gathering and the mix alone did not support a development comparable to that promoted by freshly gathered pollen and by bee bread made thereof.

The study should be repeated to cover a greater number of colonies and in which accurate estimations of protein amounts used to enrich candy will be made.

## CONCLUSIONS

1. Early spring supplemental feeding of honeybee colonies with candy made of drone brood and glucose became a promoter of egg-laying by the queens and an enhancer of the amount of brood in the colonies.
2. Later in the season, i.e. in April and in May feeding of drone brood and glucose-based candy does not enhance colony strength, and even produces an effect to the contrary.
3. For those reasons feeding bee bread substitutes in April and in June is not warranted.

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## WPŁYW WCZESNEGO PODKARMIANIA RODZIN PSZCZELICH CIASTEM Z CZERWIU TRUTOWEGO I GLUKOZY NA SIŁĘ RODZIN

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### S t r e s z c z e n i e

Siła rodzin przed pożytkiem decyduje o wysokości zbiorów miodu. Szczególnie istotne jest doprowadzenie rodziny do dużej siły wczesną wiosną, co daje możliwości efektywnego wykorzystania wczesnych pożytków, które obecnie w naszym kraju przeważają.

Często stosowanym sposobem przyspieszania rozwoju jest wczesnowiosenne podkarmianie rodzin pszczelich pierzga, ciastem pyłkowo-miodowym czy innymi substancjami. Karmienie namiastkami pyłku daje różne rezultaty i nie zawsze stymuluje wychów czerwiu. Aktywność lotna w okresie wiosennym jest dodatnio skorelowana z wysokością temperatury, a ograniczenie zapasów pyłku, będące wynikiem niskich temperatur wpływa ujemnie na rozwój czerwiu i gruczołów gardzieliowych. W tej pracy posłużono się czerwiem trutowym wymieszanym z glukozą.

Celem pracy było zbadanie skuteczności karmienia wczesnowiosennego rodzin pszczelich ciastem z czerwiu trutowego i glukozy na przyrost powierzchni czerwiu czyli siłę rodziny.

Doświadczenie było przeprowadzone w pasiece stacjonarnej, w Grabownicach - powiat

Brzozowski, wiosną 2004 r. W doświadczeniu wykorzystano 19 rodzin pszczelich, które podzielono na dwie grupy:

I grupa – 10 rodzin pszczelich podkarmiano ciastem sporządzonym z poczwarek czerwiu trutowego i glukozy,

II grupa – 9 rodzin pszczelich podkarmiano ciastem miodowo-cukrowym.

Wiosną dokonano oceny rozwoju rodzin na podstawie pomiarów powierzchni czerwiu. W wyniku przeprowadzonych doświadczeń stwierdzono, że wczesnowiosenne podkarmianie rodzin ciastem sporządzonym z czerwiu trutowego i glukozy przyczyniło się do zwiększenia ilości czerwiu w rodzinach ale tylko w czasie kiedy pszczoły nie mogły zbierać pyłku. W okresie późniejszym tj. w kwietniu i maju podkarmianie ciastem nie wpływa na wzrost siły rodziny, a nawet działa hamująco, dlatego podkarmianie rodzin namiastką pierzgi w tym okresie jest niecelowe, gdyż wtedy pszczoły mogą żywić czerw pokarmem ze świeżo zebranego pyłku i sporządzonej z niego pierzgi.

**Słowa kluczowe:** siła rodziny, czerw trutowy, rozwój rodziny.