# The influence of development stage of brood used for rearing honeybee queens on the number of obtained queen cells

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**The honeybee queens are reared predominantly from larvae. Age of the introduced brood has a major impact on queens' quality. The best queens are obtained by rearing from eggs. The aim of the experiment was to compare acceptance of eggs and larvae in nurse colonies. It was also studied if the presence of open brood in rearing colonies influences the introduced brood acceptance. Eggs and larvae were introduced to four queenless colonies with open brood. After two days the number of built up queen cells was checked. If there was not open brood in the colonies anymore, eggs were introduced again and after two days the number of built up queen cells was checked. Rearing colonies with open brood accepted 54.2% of eggs and 72.2% of larvae. Colonies without open brood accepted 58.3% of eggs and 90,3% of larvae. It was not found significant differences between eggs and larvae acceptance in rearing colonies with open brood. Bees in colonies without open brood accept significantly more larvae than eggs. The largest number of queen cells was obtained by introducing larvae to colonies without open brood but significant influence of open brood on eggs and larvae acceptance was not found.**

**KEY WORDS: honeybee / rearing of queens / nurse colonies / brood / eggs**

The quality of honeybee queens is primarily determined by the age of brood used for the rearing. The egg-laying of queens depends on the number of ovarioles and the volume of the spermatheca. The larvae used for rearing queens should be as young as possible. Queens characterized by the highest weight, number of ovarioles and the volume of the spermatheca are obtained by rearing from eggs [4, 14]. Chuda-Mickiewicz and Prabucki [1] did not find any significant differences between the quality of queens reared from the three-day eggs and one-day larvae. Örösi Pal [5] has created a method of rearing queens from eggs by grafting them with the cut bottom boards of cell. The Jenter method [3, 8] and the method of EZI Queen Technology [13] do not require to graft eggs or larvae to rear honeybee queens. Weiss [12] studied the survival of eggs outside the hive, in order to determine the egg's most appropriate age to transfer them as a breeding material. He concluded

that eggs aged from 1.5 to 2.5 days are best to be stored outside the colony. According to Ostrowska [6], the eggs used for rearing queens should be aged from 2.5 to 3 days, while Pidek [7] stated that eggs should not be older than 2 days. Gąbka et al [2] found that the highest acceptance have the oldest eggs in colonies without open brood. Certain authors [6, 7] believe that open brood should be present in the rearing colony, while according to Skowronek and Skubida [9] the presence of open brood affects negatively the profusion of larvae feeding in the queen cells and the best acceptance of larvae is found in the nurse colonies without brood. Pidek [7] reported that rearing colonies usually accept share of eggs beneath 50%. In experiments of Tworek [11] performed with use of Jenter frames, the bees have accepted 69% of three-day eggs and 83% of larvae. Chuda-Mickiewicz and Prabucki [1] obtained 56% of queens in the rearing from larvae and 40% of queens in rearing from three-day eggs.

The aim of the present study was to investigate whether development stage of brood used for rearing queens has an influence on the number of obtained queen cells. It was also investigated whether the presence of open brood in rearing colonies has an impact on the acceptance of introduced eggs and larvae.

**Materials and methods**

The experiments were conducted in August 2010 in Apiculture Division at Warsaw University of Life Sciences (SGGW). 144 eggs and 144 larvae were tested, they were introduced in two series into four rearing colonies of Carniolan breed. The rearing colonies covered 14-16 combs. The introduced eggs and larvae were derived from the queen of Italian breed. The Jenter method was used in the experiment, which allowed rearing honeybee queens from eggs and larvae. The Jenter frame has cells with removable bottoms that with the eggs or larvae are placed in special tubes which make up the queen cell cup to be introduced to rearing colonies. In order to obtain brood at certain age, the queen was isolated on two Jenter frames for two consecutive days, from 18:00 till 10:00 the next day. This method allowed obtaining eggs of 48-66 hours and larvae aged up to 18 hours on individual frames. During the goldenrod (*Solidago*) flow in the beginning of August, eggs and larvae were introduced to four rearing colonies, in which queens ware taken away approximately an hour before the introduction. 18 eggs and 18 larvae were introduced into each colony. After two days, the number of built up queen cells was checked and the breeding frames were removed. When there was no open brood present at the rearing colonies, wild queen cells were cut off. The queen was then isolated again for 2 days on the Jenter frame in order to obtain brood at certain age. Eggs and larvae were introduced as before and two days later the number of built up queen cells was investigated again. A comparison was made between four groups: 1 - eggs in colonies with open brood, 2 - larvae in colonies with open brood, 3 - eggs in colonies without open brood, 4 - larvae in colonies without open brood. Each group in total consisted of 72 eggs or larvae.

Two-way ANOVA test and the NIR test were used for statistical analysis. Calculations were performed in SPSS 17.0 software [10].

**Results and discussion**

The rearing colonies with open brood accepted 54.2% of eggs and 72.2% of larvae. Colonies without open brood accepted 58.3% of eggs and 90.3% of larvae (Figure). Overall, the bees from rearing colonies accepted in total 56.2% of eggs and 81.2% of larvae. Tworek [11] achieved corresponding results (69% of eggs and 83% of larvae). Chuda-Mickiewicz and Prabucki [1] obtained 40% of queens in the rearing from eggs and 56% of queens in the rearing from larvae. From 18 eggs and 18 larvae introduced to each rearing colony, bees in colonies with open brood accepted mean 9.7 and 13.0 respectively (Table). No statistically significant differences were stated (p=0.257). The rearing colonies without open brood accepted mean 10.5 eggs and 16.2 larvae. This difference was statistically significant (p=0.012).

Although no significant influence of the open brood on the acceptance of eggs (p=0.613) and larvae (p=0.277) was stated, the rearing colonies without open brood accepted 4.1% more eggs and 18.1% more larvae than rearing colonies with open brood. Corresponding findings were presented in the study of Skowronek and Skubida [9]. According to these authors, the greatest number of queen cells was obtained from larvae introduced into the rearing colonies without brood. The previous study [2] did not state any significant effect of the open brood on the acceptance of eggs aged up to 42 hours. Nevertheless, it was found that bees in the rearing colonies without open brood accepted significantly more eggs 48-66 hours old than the rearing colonies with open brood. These results appear to disagree with the results obtained in the present study, although eggs in previous studies [2] aged from 48 to 66 hours were the oldest among the introduced brood, while in the

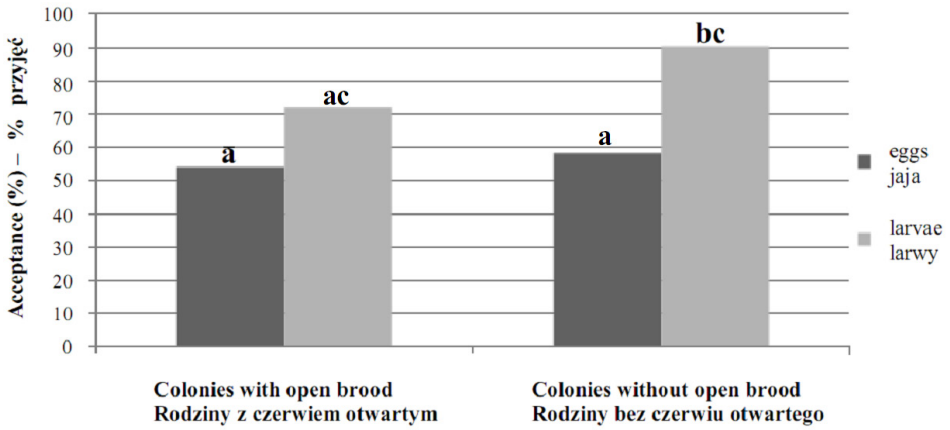


Fig. Acceptance of eggs and larvae in nurse colonies (%); different letters indicate significant differences (p<0.05)
Rys. Przyjmowanie jaj i larw w rodzinach wychowujących (%); różne litery wskazują istotne różnice (p<0,05)

**Table – Tabela**

Number of queen cells obtained from eggs and larvae
Liczba mateczników uzyskanych z jaj i larw

| Colonies<br>Rodziny | Brood<br>Czerw | Min – Max<br>Min.– Maks. | Mean<br>Średnia | Standard deviation<br>Odchylenie standardowe |
|---|---|---|---|---|
| With open brood<br>Z czerwiem otwartym | eggs<br>jaja | 8 – 11* | 9,7[a] | 1,5 |
| | larvae<br>larwy | 7 – 18 | 13,0[ac] | 4,97 |
| Without open brood<br>Bez czerwiu otwartego | eggs<br>jaja | 7 – 12 | 10,5[a] | 2,38 |
| | larvae<br>larwy | 13 – 18 | 16,2[bc] | 2,22 |

*Number of eggs or larvae accepted in one colony out of 18 introduced – Liczba jaj lub larw przyjętych w jednej rodzinie spośród 18 poddanych
a, b, c – different letters indicate significant differences ($p<0,05$) – różne litery wskazują istotne różnice ($p<0,05$)

present research, they were the youngest. It is confirmed that the open brood present in the rearing colonies does not affect the acceptance of the younger brood, yet the older brood introduced into rearing colony is more accepted in colonies without open brood.

No significant effect of the development stage of introduced brood on the number of obtained queen cells was stated for the rearing colonies with open brood. It was found that bees in the rearing colonies without open brood accept significantly more larvae than eggs. The highest number of queen cells was obtained by introducing larvae into the rearing colonies without open brood; yet the open brood had no significant influence on the acceptance of introduced eggs and larvae.

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## Wpływ stadium czerwiu użytego do wychowu matek pszczelich na liczbę uzyskanych mateczników

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

Do wychowu matek pszczelich używa się najczęściej larw. Wiek czerwiu ma istotny wpływ na jakość matek. Najlepsze matki pszczele uzyskuje się przy wychowie z jaj. Celem doświadczenia było porównanie przyjmowania jaj i larw w rodzinach wychowujących. Badano również czy obecność czerwiu otwartego w rodzinach wychowujących wpływa na przyjmowanie poddawanego czerwiu. Do czterech bezmatecznych rodzin z czerwiem otwartym poddano jaja i larwy. Po dwóch dniach sprawdzono liczbę odciąganych mateczników. Gdy w rodzinach nie było już czerwiu otwartego ponownie poddano do nich jaja i larwy, i po dwóch dniach sprawdzono liczbę odciąganych mateczników. Rodziny wychowujące z czerwiem otwartym przyjęły 54,2% jaj i 72,2% larw. Rodziny bez czerwiu otwartego przyjęły 58,3% jaj i 90,3% larw. W rodzinach wychowujących z czerwiem otwartym nie stwierdzono istotnego wpływu stadium czerwiu poddawanego na liczbę uzyskanych mateczników. Stwierdzono, że pszczoły w rodzinach wychowujących bez czerwiu otwartego przyjmują istotnie więcej larw niż jaj. Najwięcej mateczników uzyskano przy poddawaniu larw w rodzinach bez czerwiu otwartego, ale nie stwierdzono istotnego wpływu czerwiu otwartego na przyjmowanie poddawanych jaj i larw.

**SŁOWA KLUCZOWE: pszczoła miodna / wychów matek / rodziny wychowujące / czerw / jaja**