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Effect of some Artificial Diets on Brood Rearing in Three Honeybee Hybrids During The Four Seasons of The Year

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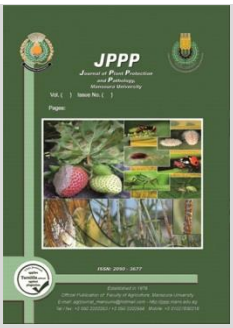

ABSTRACT

The major aim of this work was to examine the effect of some artificial diet on brood rearing in three hybrids of honeybees. Four substitutes were used throw the experiments. In mostly the Craniolan hybrid recorded open (1037.70) and (946.98) brood more than the other hybrids on the other hand the highest open and close brood were recorded in summer at all hybrids. The results showed that, the results proved that the best hybrid is the Carniolan and that the best times are summer. Results showed that the opened and sealed brood rearing cells for the three hybrids had the highest value during autumn for the Craniolan hybrid (906.08 cells) followed by the buckfast (649.58 cells). While, the lowest value was recorded for the Italian hybrid (486.18 cells). During spring season, the highest value of the opened and sealed cells was recorded for the Craniolan hybrid (980.13 cells) followed by the buckfast (563.77 cells).

Keywords: Craniolan, Italian, buckfast, summer autumn, winter, spring, diets.

INTRODUCTION

Honey bees are considered the most important insect on the planet, not only because they produce products such as honey, royal jelly, wax, propolis and poison, but also for being the most important pollinator for more than 170,000 species of plants such as almonds, cherries, apples and avocados. Honeybees provide highly valued pollination services for a wide variety of agricultural crops (Calderone, 2012) and rank as the most frequent single species of pollinators for crops worldwide (Garibaldi *et al.* 2013). Pollination is fundamental to increase production of crops (Bommarco *et al.* 2013) and serves as the backbone of complex ecological systems (Heithaus 1974). To boost pollination and fruit production, the European honeybee (*Apis mellifera* L.) has been existed to agricultural systems worldwide (Moritz *et al.* 2005). The population of honeybee decreased significantly in the past decade. Thus, this study aimed to examine the effect of some artificial diets on brood rearing in three hybrids of honeybees.

MATERIALS AND METHODS

Three hybrids of honeybee namely Craniolan, Italian and bukfast hybrids were used. Nine colonies for each hybrid were used (n = 27). The experiment was conducted during 2019 and 2020. The open and sealed brood cells of workers were counted for each colony (cell/colony) every twelve days though the experimental period.

Effect of diets on some biological activities of honeybee colonies

To examine the effect of various nutritional diets, as pollen substitutes, on some biological activities of honeybee colonies, five diets were prepared, used, and evaluated. The composition of these diets were as follows:

A. 400 g Soybean + 300 g sugar powder + 100 g pressed dates (agwa) + 100 g orange cover + 100 g apple cover.
B. 400 g Chick pea + 300 g sugar powder + 100 g Brower's yeast + 100 g dates (agwa) + 100 g orange cover + 100 g apple cover.
C. 250 g pollen + 100 g Brower's yeast + 300 g sugar powder + 50 g cinnamon powder.
D. 250 g pollen + 300 g sugar powder + 50 g cinnamon powder + 100 g apple cover.
E. 6 k-grams of pollen + 50 k-grams of sugar powder + 5-kilogram cotton honey (as a control).

Each colony was provisioned with 50 g every 15 days for three times on the top of combs during 2019 and 2020.

RESULTS AND DISCUSSION

Data in Fig (1) show the opened and sealed brood rearing cells that counted by cells/frame during summer for the three hybrids. Regarding the opened brood cells, the highest value was recorded for the Craniolan hybrid (1037.7) followed by the buckfast (853.54 cells). The lowest value was recorded for the Italian hybrid (630.26 cells).

In respect to the sealed brood rearing cells, the same trend as the opened brood rearing cells was obtained. The highest value was counted for the Craniolan hybrid (964.98 cells) followed by the buckfast hybrid (760.61 cells) and the lowest hybrid was the Italian (629.04 cells).

Data in Fig (2) show the opened and sealed brood rearing cells that counted by cells/frame during autumn season for the three hybrids. Regarding the opened brood rearing cells, the highest value was counted for the Craniolan hybrid (906.08 cells) followed by the buckfast (649.58 cells). While, the lowest value was recorded for the Italian hybrid (486.18 cells).

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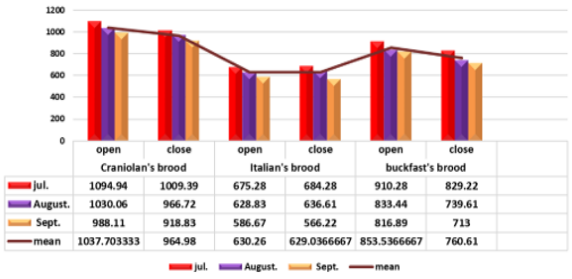
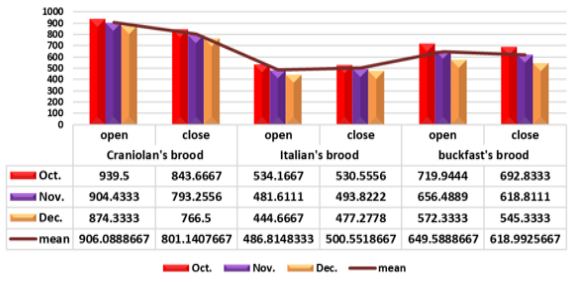
In respect to the sealed brood rearing cells, the highest value was measured for the Craniolan hybrid (801.14 cells) followed by the buckfast (618.99 cells) and the lowest value was for the Italian hybrid (500.55 cells).

Fig (1) Brood rearing (cell)at the three hybrids on summer



	open	close	open	close	open	close
	Craniolan's brood		Italian's brood		buckfast's brood	
jul.	1094.94	1009.39	675.28	684.28	910.28	829.22
August.	1030.06	966.72	628.83	636.61	833.44	739.61
Sept.	988.11	918.83	586.67	566.22	816.89	713
mean	1037.703333	964.98	630.26	629.0366667	853.5366667	760.61

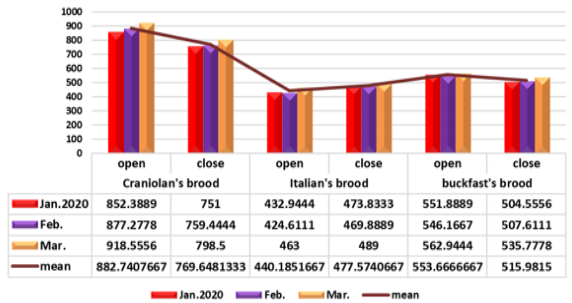
Fig (2) Brood rearing (cell)at the three hybrids on autumn



	open	close	open	close	open	close
	Craniolan's brood		Italian's brood		buckfast's brood	
Oct.	939.5	843.6667	534.1667	530.5556	719.9444	692.8333
Nov.	904.4333	793.2556	481.6111	493.8222	656.4889	618.8111
Dec.	874.3333	766.5	444.6667	477.2778	572.3333	545.3333
mean	906.0888667	801.1407667	486.8148333	500.5518667	649.5888667	618.9925667

Data in Fig (3) showed the opened and sealed brood rearing that estimated by cells/frame during winter season for the three hybrids. Regarding the open brood rearing cells, the highest value was recorded for the Craniolan hybrid (882.74 cells) followed by the buckfast (553.67 cells). While, the lowest number was recorded for the Italian hybrid (440.19 cells). In respect to, the sealed brood rearing cells, the highest number was measured for the Craniolan hybrid (769.65 cells) followed by the buckfast hybrid (515.98 cells) and the lowest value was recorded for the Italian hybrid (477.57 cells).

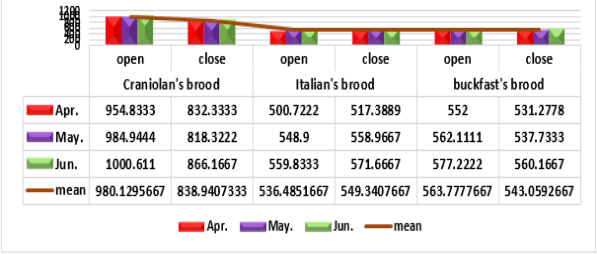
Fig (3) Brood rearing (cell)at the three hybrids on winter



	open	close	open	close	open	close
	Craniolan's brood		Italian's brood		buckfast's brood	
Jan.2020	852.3889	751	432.9444	473.8333	551.8889	504.5556
Feb.	877.2778	759.4444	424.6111	469.8889	546.1667	507.6111
Mar.	918.5556	798.5	463	489	562.9444	535.7778
mean	882.7407667	769.6481333	440.1851667	477.5740667	553.6666667	515.9815

Data in Fig (4) represent the opened and sealed brood rearing cells that counted by cells/frame during spring season for the three hybrids. For the opened brood cells, the highest value was recorded for the Craniolan hybrid (980.13 cells) followed by the buckfast (563.77 cells). While, the lowest value was estimated for the Italian hybrid (536.48 cells). Regarding the closed brood cells, the highest number was recorded for the Craniolan hybrid (838.94 cells) followed by the Italian (549.34 cells) and the lowest number was measured for the buckfast hybrid (443.05 cells).

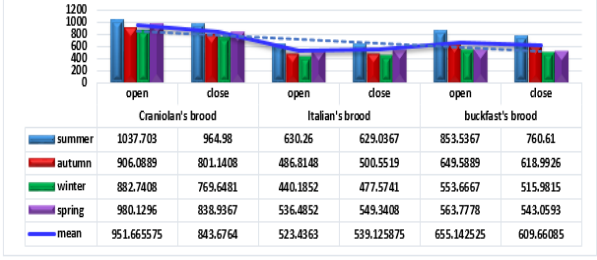
Fig (4) Brood rearing (cell)at the three hybrids on spring



	open	close	open	close	open	close
	Craniolan's brood		Italian's brood		buckfast's brood	
Apr.	954.8333	832.3333	500.7222	517.3889	552	531.2778
May.	984.9444	818.3222	548.9	558.9667	562.1111	537.7333
Jun.	1000.611	866.1667	559.8333	571.6667	577.2222	560.1667
mean	980.1295667	838.9407333	536.4851667	549.3407667	563.7777667	543.0592667

Data in Fig (5) showed the opened and closed brood rearing counted by cells/frame during all seasons for the three hybrids. For the opened brood cells, the highest number was recorded during summer season for the Craniolan hybrid (1037.69 cells) followed by the buckfast (853.54 cells). While, the lowest value was recorded during autumn season for the Italian hybrid (436.48). Regarding the closed brood cells, the highest value was recorded for the Craniolan hybrid (838.94) during spring, followed by the buckfast (629.04) during summer. While the lowest value was estimated for the Italian hybrid (477.57) during winter.

Fig (5) Brood rearing (cell) at the three hybrids at four season (2019/2020)



	open	close	open	close	open	close
	Craniolan's brood		Italian's brood		buckfast's brood	
summer	1037.703	964.98	630.26	629.0367	853.5367	760.61
autumn	906.0889	801.1408	486.8148	500.5519	649.5889	618.9926
winter	882.7408	769.6481	440.1852	477.5741	553.6667	515.9815
spring	980.1296	838.9367	536.4852	549.3408	563.7778	543.0593
mean	951.665575	843.6764	523.4363	539.125875	655.142525	609.66085

From the obtained results, It could be summarized that, the highest value of sealed and opened brood rearing cells were recorded at summer season followed by autumn for the Craniolan and buckfast hybrids, respectively

Many researchers discussed this issue and found the following, The amount of pollen and brood in the colony reflects its status and can be used to expect the honey yield that might produce at the end of the season. Several researchers have been emphasized positive relationship between stored pollen, brood production and honey yield (Jevtic *et al.* , 2009).

Several internal and external factors have been found to effect the collection of pollen by bee workers. Among the internal factors, the high area under brood in the colony stimulates the workers to collect more pollen. The external factors are weather factors such as temperature, wind, rain and light (Kaur and Kumar, 2013).

Colonies of honey bee need nutritional provisiontion to keep the colonies healthy, especially during period of scarcity periods or when bees are planned to pollinate crops (Brodschneider and Crailsheim, 2010)

Abd El-Wahab and Gomaa (2005) have been examined the effect of honey bee feeding with an artificial

diet composited of pure liquid culture of yeast at various concentrations, as pollen grains substitute. Feeding on 25 and 50% of the yeast culture yielded the higher amount of worker brood and higher number of combs that covered with bees than other traditional artificial diets in cake form. But, Abd El-Wahab et al. (2016) found that feeding honeybee colonies with artificial diets containing yeast and vitamins in cake form, yielded a significant number of worker brood cells.

Brodschneider and Crailsheim (2010) stated tha, pollen provides bees with lipids, protein, and vitamin and mineral nutrients. Honey, nectar an d pollen are consumed and used to produce a protein rich brood food, which is fed to the queen and developing larvae (Hodowla, 1983). Bee behaviour is very sensitive to changes in levels of stored food or food influx. Pollen is the only protein source to honeybee colony gathered by bee foragers in their habitat. The amount of pollen that is covered its need ranged from ca. a dozen to more than 35 kg. The avaliability of pollen in the beehive is a precondition for regular growth and normal development of bee brood. The composition of amino acids is rich in pollen protein and the high-value superstructure of pollen (fats, enzymes, vitamins, phytohormones, mineral compounds) make it as one of the main gathered products by bees that recovered by human, what is often referred to as bee pollen (Wilde and Wilde, 2002).

REFERENCES

Abd El-Wahab, T. E. and Gomaa, A. M. (2005). Application of yeast culture (*Candida tropicalis*) as pollen substitute in feeding honeybee colonies (*Apis mellifera* L.) in Egyptian. Journal of Basic and Applied Sciences 1: 386-390.

Abd El-Wahab, T. E., Ghania, A. M. M. and Zidan, E. W. (2016). Assessment a new pollen supplement diet for honeybee colonies and their effects on some biological activities. Journal of Agricultural Science and Technology 12: 55-62.

Bommarco, R., D. Kleijn, and S.G. Potts. 2013. Ecological intensification: Harnessing ecosystem services for food security. Trends in Ecology and Evolution 28: 230-238.

Brodschneider R and K. Crailsheim 2010. Nutrition and health in honey bees. Apidologie 41: 278–294.

Calderone, N.W. 2012. Insect pollinated crops, insect pollinators and US agriculture: Trend analysis of aggregate data for the period 1992–2009. PLoS ONE, 7, e37235.

Garibaldi, L.A., Steffan-Dewenter, I., Winfree, R., Aizen, M.A., Bommarco, R., Cunningham, S.A., Kremen, C., Carvalheiro, L.G., Harder, L.D., Afik, O., Bartomeus, I., Benjamin, F., Boreux, V., Cariveau, D., Chacoff, N.P., Dudenhüoffer, J.H., Freitas, B.M., Ghazoul, J., Greenleaf, S., Hipo´lito, J., Holzschuh, A., Howlett, B.G., Isaacs, R., Javorek, S.K., Kennedy, C.M., Krewenka, K., Krishnan, S., Mandelik, Y., Mayfield, M.M., Motzke, I., Munyuli, T., Nault, B.A., Otieno, M., Petersen, J., Pisanty, G., Potts, S.G., Rader, R., Ricketts, T.H., Rundlüof, M., Seymour, C.L., Schüuepp, C., Szentgyüorgy, H., Taki, H., Tscharntke, T., Vergara, C.H., Viana, B.F., Wanger, T.C., Westphal, C., Williams, N., and A.M. Klein 2013. Wild pollinators enhance fruit set of crops regardless of honey-bee abundance. Science 339, 1608–1611.

Hodowla P. 1983. Autumn season in Bhimal, India. Taiwania Pracaz biorowa.PWRILWarszawa 41 (3), 197–207.

Jevtić, G., Mladenović, M., Andjelković, B., Nedić, N., Sokolović, D. and R. Štrbanović 2009. The correlation between colony strength, food supply and honey yield in honey bee colonies. J. Biotechnology in Animal Husbandry (25): 1141-1147.

Kaur, R. and N. R. Kumar 2013. Pollen foraging activity of *Apis mellifera* during autumn season in Chandigarh . Halteres 4: 12-14.

Moritz, R.F., S. Härtel, and P. Neumann. 2005. Global invasions of the western honeybee (*Apis mellifera*) and the consequences for biodiversity. Ecoscience 12:289-301.

Wilde J., and M. Wilde 2002. U¿ytkowanieselekcjonowanych pszczó³ miodnychwarunkiem op³acalnego prowadzeniapasiek.Biul.Nauk., 18, 61 – 67.

تأثير بعض بدائل حبوب اللقاح على تربية الحضنة في ثلاثة أنواع من نحل العسل خلال فصول السنة الاربعة

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الهدف الأساسي من هذا العمل هو دراسة تأثير بعض بدائل حبوب اللقاح على تربية الحضنة في ثلاثة أنواع من نحل العسل. تم استخدام أربعة بدائل في التجارب. وقد سجل هجين Craniolan حضنه مفتوحة (1037.70) وحضنة مغلقة (946.98) أكثر من الهجن الأخرى من ناحية أخرى، تم تسجيل أعلى حضنه مفتوحة ومغلقة في الصيف في جميع الهجن. وأظهرت النتائج أن أفضل أنواع الهجن هو الكرنيولي وأن أفضل الأوقات هو الصيف. اظهرت النتائج ان اعلي قيم لعيون الحضنة المفتوحة والمقفولة خلال فصل الخريف كانت لسلة النحل الكرينولي وجاء بعدها سلالة النحل ال Buckfast. بينما اقل قيم كانت لسلالة النحل الايطالي. كما اظهرت النتائج خلال فصل الربيع ان اعلي قيم لعيون الحضنة المفتوحة والمقفولة كانت لسلة النحل الكرينولي وجاء بعدها سلالة النحل ال Buckfast.