

EFFECT OF FEEDING FOUR POLLEN TYPES ON SOME HONEYBEE CHARACTERS (*Apis mellifera* L.)

Fawzey, Asmaa M.; E. A. Nafea and Sawsan S. El Mohandes
Plant Protection Research Institute, Agriculture Research Centre

ABSTRACT

Four pollen types were chosen, maize (*Zea mays*), clover (*Trifolium alexandrinum*), date palm (*Elaeis guineensis*) and faba bean (*Vicia faba*) collected by honeybees to investigate the feeding effects of honeybee colonies with these pollen types on some of their characters. These characters included the weight of the newly emerging worker and length and width of wax glands. Also included the amount of total protein in bodies of honeybee workers and drones, in hypopharyngeal glands and in sting glands. No significant difference was observed in the weight of newly emerged workers feeding with these pollen types. The same result was also found in the length and width of the wax glands of the honeybees. The highest total protein percentage was found in date palm pollen (30.50%), while the lowest was found in maize pollen (15.62%). No significant difference was found in the total protein values in the bodies of worker larvae, newly emerging worker, nurse bees, and adult drones. While there were slightly significant differences among, the mean quantity of protein values in the body of forager bees. No significant difference in the total protein of both hypopharyngeal and sting glands was found.

INTRODUCTION

Pollen is a necessary for bees feeding diet and without it brood rearing would diminish very rapidly and the activation of the hypopharyngeal glands would not occur. Pollen is not only the principal protein source to bees, but also provides vitamins, minerals and fats essential for the survival and development of the honey bees. (Schmidt and Buchmann, 1992). The protein content of pollen can vary from 7 to 30% (by weight) with an average of about 22%. It is required for the development of glands (e.g hypopharyngeal glands, wax glands) during the behavioral ontogeny of worker bees (Amdan and Omholt, 2002). If nurse bees do not get pollen or some other appropriate protein source, their brood food gland secretions are not adequate for support of normal growth and development of the larvae and egg production of the queen (Standifer *et al.*, 1977, and Crailsheim and Stolberg, 1989). Baryczko and Szymaoe (2001) found a higher average degree of pharyngeal gland development in bees that were fed bee bread.

The pollens or protein supplement diet of emerging bees and nurse bees should contain protein with an amount and variety of amino acids that will satisfy their nutritional need (Standifer *et al.*, 1977). Pollen pellets from 15 species were identified as providing protein levels below those acknowledged to satisfy honey bee dietary requirements when they are the only source of pollen available to the honey bee colony (Somerville and Nicol, 2006). Babendreier *et al.*, (2004) suggesting that oilseed rape pollen is of greater nutritional quality for honey bees than is field bean pollen. Honey bee foraging preferences appeared to reflect pollen quality (Cook *et al.*, 2003). Bees with high levels of body protein live longer than bees with lower body

protein levels. The longer bee lives, the more opportunity it has to collect greater quantities of nectar/honey (Somerville, 1999).

This study investigated the feeding effects of four pollen types (maize, clover, date palm and faba bean) collected by the honeybees on some of their characters. These characters include the weight of newly emerged worker, length and width of the wax glands, the amount of total protein, in the bodies of honeybee workers (larvae, emerg, nurse bees and forager bees), in the bodies of adult drones, and in both hypopharyngeal and sting glands.

MATERIALS AND METHODS

Twelve honey bee colonies of about equal strength of the first hybrid local Carniolan bee's race (*Apis mellifera carnica*) were chosen. This work was achieved in the apiary of Beekeeping Research Department, Plant Protection Research Institute, Agriculture Research Center at Dokki, Giza Governorates through spring and summer of 2007. Four groups were chosen each group contained three colonies.

The pollen used in the experiment was collected by bees from four plants, maize (*Zea mays*), clover (*Trifolium alexandrinum*), date palm (*Elaeis guineensis*) and faba bean (*Vicia faba*) from different regions (Giza Governorate) during 2007 growing seasons by putting pollen traps on the entrance of the hives. These pollen grains were readily recognized from standard reference sources. All pollen materials were sealed in glass jars and stored at -20°C shortly after collection until use. Pollens were thoroughly mixing with sugar powder (1 pollen: 1 sugar) and distilled water was added until a moist kneads able and stable texture was obtained. Each colony was initially given 50 g patties every week placed directly over the brood combs covered with plastic sheets to avoid drying. These colonies were fed for six weeks. Sucrose syrup (2 sugar: 1 water) was continuously provide to every colony under investigation.

These pollen types were compared to determine the following criteria:

Effects of the pollen types on the weight of the newly emerged workers and also on the length and width of the wax glands .

Determination of total protein in homogenous of the pollen types under investigation, the body of worker larva, newly emerging workers, nurse bees, forager bees, adult drones, hypopharyngeal glands and sting glands . Total protein was determined according to AOAC (1995).

RESULTS AND DISCUSSION

Table (1) showed that the highest mean weight was 0.1050 gm in maize pollen type while the lowest mean weight was 0.0985 gm in date palm pollen type. Statistical analysis showed that no significant differences among the weight of the newly emerging workers feeding with these four pollen types. Honeybee colonies may differ in their use of the pollen available at a given location. Different pollen types were found to vary considerably in their effectiveness, with some low quality pollen types having as little impact on

physiological development as pure carbohydrate diet. (Maurizio, 1950) and Chhuneja *et al.*, (1993) observed that the mean weights of individual nurse bees and foragers bees were significantly higher in colonies fed two types of patty containing soyabean. Baryczko and Szymaoe (2001) found fresh body weight to be higher by 8% in bees that were fed pollen from pollen loads.

Table (1): Effect of the pollen types on the weight (gm) of the newly emerged worker

Treatment	Faba bean	Maize	Clover	Date palm
weight	0.0998	0.1050	0.1015	0.0985
F	0.09963	0.10493	0.09852	0.10147
LSD	0.007152			

Table (2) showed that the highest length and width of wax glands were obtained by feeding honeybees with faba bean and clover pollen, respectively. While the lowest length and width was obtained by feeding honeybees with date palm and faba bean pollen, respectively.

Statistical analysis showed no significant differences found among length and width of wax glands of honeybees feeding with these four pollen types.

Table (2): Effect of pollen types on the length (mm) and the width (mm) of wax glands

Treatment	Wax glands of honeybee worker	
	Length	width
Faba bean	2.83	4.57
Maize	2.71	4.60
Clover	2.75	4.64
Date palm	2.67	4.58
F	1.231	0.625
LSD	0.199	0.16

Table (3) showed that the highest total protein percentage was obtained by feeding honeybees with date palm pollen (30.50%), while the lowest was obtained from maize pollen (15.62%). Statistical analysis showed no significant differences among the mean quantity of protein values in the bodies of worker larvae, nurse bees, newly emerging worker, adult drones, while there were slightly significant differences in the mean quantity of protein values of forager bees. Worker honeybees start to consume large quantities of pollen within the first 42 to 52 hours after emergency (Hagedorn and Moller, 1967). The pollen content of the gut reaches a maximum in 8-9 day old workers and then decrease to very low levels in individuals older than 20 days (Loidl and Crailsheim, 2001).

Hanley *et al.*, (2003) mentioned that there were no significant differences in larval and pupal mortalities, pupal weight, and haemolymph protein concentration of newly emerged adults after they were fed (as larvae) various pollens.

Table (3): Total-protein values (gm/100gm) in pollen types and in different stages of honeybee workers and drones.

Treatment	Pollen content	Worker larvae	Emergency bees	Nurse-bees	Forager bees	Adult-drones
Maize	15.62	0.644	27.77	30.17	17.58 (ab)	26.17
Clover	21.88	0.616	35.42	18.47	24.69 (b)	25.76
Faba bean	24.92	0.571	31.99	29.28	25.72 (ab)	26.79
Date palm	30.50	0.508	27.05	33.33	33.99 (a)	26.48
F		1.024	1.305	1.024	2.133	1.477
LSD		0.191 ns	11.148 ns	20.55 ns	15.02 *	1.17 ns

-Data followed by different litters have significant difference.

-Data followed by the same litter have no significant difference

From the results in (Table 4) it was observed that there was no significant difference in the mean total protein in both hypopharyngeal and sting glands for worker bees (5-12 days and 12-20days ,respectively) when feeding different pollen type. Crailsheim *et al.*, (1992) found that the size of the hypopharyngeal glands showed similar age dependence on the intensity of pollen consumption, it reached a maximum in 1- day old bees, and the worker consumed about 3.4 to 4.3 mg of pollen per day. More accurate estimates of the protein requirement of larvae can be obtained by examining their nitrogen content. Hydak (1935) mentioned that groups of bees without access to pollen used 3.21 mg of their body nitrogen to rear one worker. Pupae and newly emerged adults contained between 1.73 and 1.87 mg of nitrogen (Hydak 1934, 1959; Imdore *et al.*, 1998). Alfonsus (1933) and Hydak (1934) indicated that a consumption of 68 – 73 mg of pollen per worker larvae. Consequently, the nitrogen content of larvae will be higher than that of pupae or emerging adults.

The highest food consumption was recorded when bees fed on date palm pollen followed by bee bread and the lowest was recorded for Haydak's diet. Feeding bees on bee bread gave the longest LT50. On the other hand, the honeybee workers fed on date palm pollen and Haydak's diet gave LT50 values of 18.16 and 19.52 days, respectively. The results indicated that the normal source of protein for honeybee workers as bee bread or date palm pollen were the best sources for hypopharyngeal gland development (3.83, 3.41 degrees) respectively. These results indicated that, the addition of pollen to honeybee diet activated the hypopharyngeal glands development (Abdilla, 2005).

In conclusion, no experimental study has so far provided conclusive evidence of preferences for high quality pollen in honeybee. It is well possible that colonies regulate the quantity rather than the quality of the pollen that is collected.

Table (4): Mean total protein (gm/100gm) in both hypopharyngeal and sting glands of honeybee worker

Treatment	Hypopharyngeal gland	Sting gland
Faba bean	3.82	13.72
Maize	4.73	13.16
Clover	3.89	18.90
Date palm	4.81	14.14
F	1.16	1.21
LSD	1.61 ns	7.84 ns

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تأثير تغذية اربعة انواع حبوب اللقاح على بعض صفات نحل العسل أسماء محمد فوزي ، عماد الدين أحمد نافع و سوسن سعيد المهندس قسم بحوث النحل - معهد بحوث وقاية النباتات - مركز البحوث الزراعيه

تم تجميع اربعة انواع من حبوب اللقاح (القول - الذره - البرسيم - نخيل البلح) بواسطة مصائد حبوب اللقاح بمحافظة الجيزة، وتم دراسة تأثير تغذية طوائف نحل العسل بحبوب اللقاح على بعض صفات نحل العسل.

الصفات المورفولوجية تشمل وزن الشغالات حديثة الفقس وطول وعرض غدده الشمع. وقياس البروتين الكلى فى اجسام الأطوار المختلفة لكل من الشغالات وذكور نحل العسل. وكذلك تقدير البروتين الكلى فى غدده السم و غده الغذاء الملكى، وقد وجد أن أعلى قيمة للبروتين الكلى يوجد فى حبوب لقاح نخيل البلح وأقلها كان فى حبوب لقاح الفول. ووجد أيضاً انه لا توجد فروق معنوية بين الطوائف التى غذيت على حبوب اللقاح المختلفه من حيث قيمة البروتين الكلى فى أجسام يرقات وشغالات النحل حديثة الفقس وكذلك النحل الحاضن والذكور البالغة بينما وجدت فروق معنوية بين قيمة البروتين الكلى داخل أجسام النحل السارح. وبالمثل لم توجد فروق معنوية فى البروتين الكلى لكل من غده الغذاء الملكى وغده السم.