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THE EFFECT OF SUPPLEMENTAL FEEDING OF HONEYBEE COLONIES ON PACKAGE-BEES PRODUCTION AT GIZA REGION, EGYPT

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ABSTRACT

The effect of feeding pollen supplements on *Apis mellifera* L. population and the economic value of feeding colonies for spring or summer production of package bees was studied on thirty colonies of F1 Carniolan race. Five feeding treatments (6 colonies each), were evaluated from the beginning of dearth period (autumn season) to compare the benefit of feeding. Colonies fed with checkpea flour + Yeast (2:1) +syrup produced population of adult bees which significantly increased 4.25 times and 2.64 times than control treatment for spring and summer net income , respectively. The net income for feeding treatments of Extra bee, soyabean flour +yeast (2:1) + syrup and skimmed milk were high with (3.25 &2.52 times), (2.43 & 1.9 Times) and (1.4 &1.42 times) than control colonies for spring and summer production , respectively

INTRODUCTION

Pollen is the main source of protein, lipids, minerals and vitamins that necessity in building different tissues of bee workers and drones (Diets, 1979 and Szymas& Przybyl, 1995). So, honeybees use the natural collected pollen in rearing their brood and increasing colony population, (Greham, 1992). Therefore, the brood rearing activity is declined when the natural pollen sources are inadequate or scarce, which reflect, in turn, on the productivity of those colonies, (Haydak, 1970 and Doull, 1980). Thus many researchers recommended beekeepers to food their honeybee colonies with pollen supplements or substitutes to maintain the brood rearing activity and colony population not only during pollination of crops and exploiting honey flows but also at other times to compensate for pesticide damage ,enhancing packages and queens production and to overcome autumn collapse ,(Stanger and Laidlow, 1974., Peng, *et al.*, 1984., Abu-Zaid and Abd Al-Fattah, 1988., El-Shemy, 1997., El-Shaarawy, 2001., El-Waseef, 2002 and Hammad, 2007).

In the current decade, the production of nucs and package bees is one of the important aspects of progressive beekeeping in Egypt .Package bees was produced and yearly exported to the other countries, especially Arab countries, during spring and summer seasons.These exported package accounted 43.9% of the total income from beekeeping, (Selim, 2007). Therefore, obtaining high populations of adult bees during these seasons is of particular interest to beekeepers who produce package bees.

Several food materials that can either supplement pollen or substitute for pollen have been investigated as stimulating factors for different activities of honeybee colonies, among these protein-rich food materials, e.g., Soya bean flour, (Stanger and Laidlow, 1974., Mohanna, 1977., Herbert and Shimanuki, 1980., peng *et al.*, 1984., Abu-Zaid and Abd Al-Fattah, 1988.,

Abdel-Azeiz, 1992., El-Shemy,1997., Abdel-Wahab and Gomaa , 2005 and Hammad, 2007).

On the other hand , the autumn season in Egypt is worst season for beekeepers as results of application of cotton pesticides, injuries by the oriental hornet, *Vespa orientalis* , and the destructive parasitic mite, varroa destructor (El-Shemy, *et al.*, 1995). For the above reasons, the present work was conducted in the field experiment for a year started from the beginning of dearth period (September,2006) to investigate the effect of some protein diets as pollen supplements on brood rearing activity.Besides, how many these diets should be given to colonies for the development high populations of adult bees. The economic significance of feeding bee colonies in the field was also taking in consideration.

MATERIALS AND METHODS

Experimental honeybee colonies

Thirty F1 Carniolan honeybee colonies, headed by open mated hybrid queens at the same age were prepared for the feeding experiment at the apiary of Agricultural Experimental Station, Faculty of Agriculture, Cairo University from the beginning of September 2006 to the end of August 2007. The colonies each, contained 1.3 kg. of adult bees (about 11700 bees), two of open and sealed brood combs (about 100 inch), two combs of honey and pollen and one empty fully drawn comb.

The colonies were randomly divided into equal five groups. Four groups were given one of the following protein diets while the fifth was provided with sugar syrup alone (used as control group).

Protein supplements and feeding treatments.

Based on the level of protein found in fresh bee collected pollen, 7-40 %, (Johansson and Johansson, 1977) and the previously tested experiments at the same area, (Abd-Al Fattah and El-Shemy , 1989) the formulation of the following pollen supplements were prepared :

1- Check pea flour (2 parts) + yeast (one part)
2- Soya bean flour (2 parts) + yeast (one part) Each formulation was mixed with 150 grams sugar as a sugar solution 1:1 (w/w) to make soft patties. Fifty grams of each protein diet was introduced to colony in small plastic Petri dish over the brood combs.
3- Children skimmed milk (ph 6.5) and 150 grams of sugar in ratio of 1:1 to offer 50 grams of diet for each of the six tested colonies
4- Extra bee solution (25 % amino acids) in level of 2.5 cm/ liter of 60 % sucrose syrup (w/w).
5- Sugar syrup (1:1) with 650 grams sugar/colony as control treatment. The amounts of feeding treatments 1, 2 and 3 were prepared in small patties in the beginning of experiment (50gr./col./week), then increased with consumption progression.

Population estimation :

Adult bee populations were estimated at 21 day intervals from 11/9/2006 to 2/9/2007.

The population was determined by subtracted the weight of combs without bees from the weight of the same combs covered with bees. Then, the difference (the weight of bees) was divided on the mean weight of individual bee (110 mg) as described by (Abd- Alhady , 2007).The brood population was estimated by measuring the brood surface area (in^2.) with a frame divided into square inch ,(Abd Al-Fattah, 1983) . When the population grew, additional combs and chambers were given to the colonies to provide more laying space to the queen bees and storage space for food.

Cost and benefit estimation:

Spring , (March) and Summer ,(August) bee populations were taken into consideration for production of package bees because the colony population was high in spring and reach its climax during summer season in Giza region , (Zeedan ,2002) . In addition, March is still in the prime season for package bee production and August is a time after the last season of nectar flow from cotton flowers in Egypt. The number of adult bees was then converted into weight one ,Kg. of bees contained an average of 9091 bees.

The cost of each protein supplement was $ 27.3 for the liter of Extra bee , $ 2.7/kg of check pea , $ 2.9/kg of medical drying yeast , $ 1.8/kg of Soya bean flour , $ 8.2/Kg. of children skimmed milk and $ 0.55/Kg. of sugar . The increase of the bee population during spring (after 33 weeks) or during summer (after 45 weeks) was calculated by subtracting the initial population, (11700 bees). The increase was then converted to the number of one-kg package of bees, (one commercial package is one kg.) . One package bee (without the queen bee) was estimated to be worth $ 20 at 2005 prices. Therefore , the net gain in dollars was obtained by : ($20 x no. of packages plus $ 3 x amounts of Extracted honey in kg.) minus feeding cost ($) . The cost of labor and equipment were not included in the study.

Data analysis:

The effect of feeding treatments and the cost and benefit were analyzed by two way analysis of variance and the treatment means were compared by Duncan's multiple range test (Steel and Torrie , 1960) .

RESULTS AND DISCUSSIONS

Effect of feeding on brood rearing and bee population:

The honeybee colonies completely consumed all the pollen supplements and sugar syrup during the feeding experiment. The presented results in Fig. (1) show that, in all protein feeding treatments, colonies reared more worker brood than those provided with only sugar syrup (control treatment) . The brood rearing activity was sharply declined or ceased in some colonies in November, December and January. The seasonal pattern of brood and adult bee populations showed that bee populations started to decline at the end of October and reached their minimum in November and or December. Beginning in February the populations rose again and reached the maximum in July and August , Fig.(2). The rate of brood rearing activity was speedily raised during spring to reach its first peak in April and the second and major peak during July.

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Therefore, beekeepers could produce package bee or nucs during March or April before the onset of the main nectar flow in the middle of May,(Zeedan, 2002) . Another period for production of packages could be attained during August through the highest rate of bee population within colonies,

The colonies fed with check pea and yeast plus sugar syrup had significantly higher ,($p<0.05$) populations than those provided with pollen supplements of Soya bean, skimmed milk or sugar syrup only, during both spring or summer production, Table(1) . However, no significant differences between check pea and Extra bee pollen supplements or between Extra bee and soya bean treatments, in the two seasons of packages production, Table (1) . On the other hand, colonies fed with sugar syrup alone produced significantly lower bee populations than colonies receiving other feeding treatments except the treatment of skimmed milk, (Table 1 and Fig 2). It is appeared that supplemental feeding of honeybee colonies during the dearth period could make the colonies produce more adult bees in the early spring when compared with colonies provided with sugar syrup alone This Extra bee population enables the beekeepers to produce a portion of the demand package bees during spring season. Therefore, it could be concluded that bees provided with protein supplement during dearth period are very likely to be in better physiological conditions. such plenty conditions enable the bee workers to secrete an abundant of enough larval food for brood provisioning. Consequently, the colonies produce more adult bees. Haydak, 1970 and Maurizie, 1954 have reported that the hypopharyngeal glands of the worker bees cannot produce larval food if bees are fed sugar syrup alone for prolonged periods of time under the circumstance of experiment, the available pollen during spring season are less than the needs of honeybee colonies , (El-Shakaa, 1977).

Therefore, pollen supplements should be recommended until the pollen was offered from the first major pollen source, (Abd Al-Fattah & El-Shemy, 1989 and El-Shemy, 1997) .

Estimation of cost benefit:

The cost of feeding and the number of package bees produced beside the amount of stored and Extracted honey in spring,(March) , and summer,(August) are summarized in Table (1) .

The net income in dollars from production of package bees and honey is converted into number of increasing times than control treatment. This times of increase was illustrated in Fig. (3).

It is appear from results in Table (1) and fig. (3) that protein supplement with syrup was more profitable than feeding syrup alone in the two season's production. Colonies provided check pea and yeast had the highest net income during spring and summer production. Extra bee and soya bean with yeast came next in the pattern of net income/colony. In this respect, production of package bees at the end of honeybee active season, (August) is more profitable than during spring season the effect of type of protein supplement on be populations is clear during spring or summer production of package bees.

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Providing colonies with check pea and yeast (2:1) resulted increase in bee population equal 2.8 or 3.12 package bees during spring or summer seasons, respectively and attained the highest net income of the tested supplements. No significant difference was found between check pea and Extra bee treatments, Soya been and yeast (2:1) was significantly increased than control (syrup alone) treatment. However, the lowest net income was occurred with treatment of skimmed milk mixed with sugar syrup .

Table 1. Feeding cost, net income and the effect of feeding treatments on bee population, increase in bee population as compared to initial population and No. of package bees produced in spring and summer seasons, (2007).

Treatment	Feeding cost $/ colony	Final popul./ col.	Seasonal increase/col.	No. packages produced/ col.	Honey yield/ col. (Kg.)	Net income($) /col.	Income increasing rate
	Spring season						
Extrabee	14.1	33.9	22.6±3.51 ab	2.3	2.8	40.3	3.25
Chekpea	13.5	39.1	27.8±6.041 a	2.8	3.4	52.7	4.25
Soya bean	12.9	29.5	18.2±3.914 bc	1.82	2.2	30.1	2.43
Skimmed milk	14.4	24.7	13.4±3.561 cd	1.34	1.6	17.2	1.4
Sugar (Cont.)	11.8	21.3	10.0±1.127 d	1.0	1.4	12.4	1
	Summer season						
Extrabee	19.2	39.3	28.3±3.489 ab	2.83	4.5	50.9	2.52
Chekpea	22.9	41.8	31.2±5.811 a	3.12	4.6	53.3	2.64
Soya bean	21.9	33.9	23.7±1.961 bc	2.37	4.3	38.4	1.9
Skimmed milk	24.6	31	19.7±3.652 cd	2.0	4.4	28.6	1.42
Sugar (Cont.)	16.1	26	14.7±1.952 d	1.5	2.1	20.2	1.0

Means in the same column with the same letter don't differ significantly according to Duncan's Multiple Range Test at 0.05 probability

Conclusion

. In conclusion, this investigation proved that fed honeybee colonies with any pollen supplements (especially treatments 1,2 and 3) from the beginning of fall season will support these colonies to stimulate in brood rearing early in the spring and attained high net income when compared with colonies fed with sugar syrup alone .

It is appeared from this study that , under Egyptian circumstances, providing honeybee colonies with any rich protein diet during the dearth period will increase the rate of brood rearing. This, in turn, will positively reflect on the adult bee population during the followed spring and summer seasons. So, the number of package bees that could produced from this colonies could increased , then the potential productivity, as income net gain, raised .

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تـأثير التغذيـة المدعمـة لطوائـف نـحل العسل علـى إنتـاج طـرود النـحل المـرزوم فـى منطقة الجيزة- مصر

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استخدم ثلاثون طائفة نحل عسل من الهجين الاول الكرينيولى لمعرفة تأثير خمسة انواع من التغذيه البروتينيه المدعمه لانتاج طرود النحل المرزوم خلال فصلى الربيع والصيف ، وقسمت التجربه الى ٥ معاملات (٦ خلايا لكل معامله) وبدأت تغذية الطوائف فى فترة ركود النحل (موسم الخريف ٢٠٠٦) .
واختبرت الوجبات الغذائيه التاليه كمعاملات :
المعامله الاولى : محلول Extra Bee
المعامله الثانيه : دقيق الحمص + الخميره (٢ : ١) + المحلول السكرى
المعامله الثالثه : دقيق فول الصويا + الخميره (٢ : ١) + المحلول السكرى
المعامله الرابعه : اللبن الفرز + المحلول السكرى
لمعامله الخامسه : معاملة الـ Control (محلول سكرى فقط)
وتم التوصل الى النتائج التاليه :

- حقق تعداد النحل للمعامله الثانيه زياده بمقدار (4.25 ، 2.64 مره) عن طوائف الكنترول فى انتاجية طرود فصلى الربيع والصيف على الترتيب .
- وكان مقدار الزياده فى تعداد النحل (3.25 ، 2.52 مره) للمعامله الاولى عن طوائف الكنترول ، بينما بلغت هذه الزياده (2.43 ، 1.90 مره) ، (1.40، 1.42 مره) فى تعداد النحل فى فصلى الربيع والصيف للمعامله الثالثه والرابعه على الترتيب .

ونستخلص من ذلك ان تغذية الطوائف بمدعمات حبوب اللقاح يزيد من انتاج طرود النحل المرزوم مما يحقق عائدا اقتصاديا مجزيا لمربي النحل .