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Evaluation of FEEDBEE® under Egyptian condition

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Abstract:

Proteins are an important determinant of the growth of many organisms. Social insect such as honey bees provide protein sources to their individuals and stored them, lake of protein sources is negative reflacting of brood rearing in honey bee colonies, worker's population and colonies activities. So, under condition of lack pollen yield or using pollen traps, it necessary to compensation of colonies with pollen substitutes materials, such as FEEDBEE®. Form evaluation data at spring season under Egyptian condition, powder FEEDBEE® 5gm/L of sugar syrup (1:1), was perfect to provide colonies with pollen substitutes with high significant effects on worker's population, brood rearing areas, and showed lowest significant effect in stored beebread.

Introduction

Worker bees do not have substantial protein reserves in their bodies; therefore, they require a daily diet of about 3.4 – 4.3 mg of pollen, depending upon their age, to make up this nutritional deficiency. A typical 10-combs covered with bees consumes between 13.4 and 17.8 kg of pollen annually (Crailsheim *et al.*, 1992). Pollen is a food of complex chemical makeup, the protein being the ingredient of the greatest importance for bees. Breaks of prolonged duration in the supply of that food to bee colonies may negatively affect the development and the functioning of a bee colony (Rogala and Szymaoe, 2004). In such cases pollen collected with bee traps during high pollen flow or pollen substitutes should be fed to colonies (Doull, 1980 a,b ; Peng *et al*., 1984 and Chambers, 1990). The basic food for honey bee is represented by honey as energetic source and pollen that rich in protein, vitamins, enzymes, mineral and lipids, etc. Which is necessary for the growth, development and activity of honey bees, when brood-rearing was limited for long periods when pollen was available in the field and that it ceased completely in the absence of pollen (Parker, 1926) and fed colonies with pollen substitutes increase of brood production of 43 and 73% in colonies fed substitute comparative with colonies fed equivalent amounts of syrup instead (Wille and Schafer, 1970). It is almost necessary to indemnity honeybee when colonies lacking natural pollen yield with pollen supplies or substitutes material that survival honeybee colonies strength. The activity of honey bee colonies to rear a brood is highly dependent on the contribution of a suitable protein in food, as well as on its quality, to activate their hypopharyngeal glands (Mostafa, 2000). Larvae are especially dependant on protein and brood production is strongly affected by shortages of this nutrient. The

number of larvae reared may be reduced to maintain the quality of remaining offspring. The quality of developing workers also suffers under conditions of larval starvation, leading to slightly affected workers. Larval starvation, alone or in combination with other stressors, can weak colonies. The potential of different diets to meet nutritional requirements or to improve survival or brood production is outlined (Brodschneider and Crailsheim, 2010).

The aim of this work is to evaluate FEEDBEE® as pollen substitute under Egyptian environmental condition.

Materials and Methods

The evaluation of FEEDBEE® as pollen substitute carried out in apiary of Beekeeping Research Department, Plant Protection Research Institute, Agriculture Research Centre, Giza, Egypt. Assessment was done for nine weeks started in 23 Feb.2017 and finished 29 April 2017.

1. FEEDBEE® concentration:

For evaluation FEEDBEE® powder (FB.) using three concentrations (5, 6 and 7gm/L) in sugar solution (1:1) 500ml/colony two time a week. FEEDBEE® substitute (FB.S.) which content minimum protein 33.0%, 2.0% fat, 28.0% carbohydrate, 20.0% sugars and maximum 4.0% fiber, 4.0% mineral 0.15% calcium, 0.50% phosphorous, 23.0% moisture; was evaluated in the same time 500 gm/colony

2. Colonies preparation:

Fifteen honeybee's colonies equal strength were chosen and headed by new sister under this experimental, four treats triplicate and comparative with control negative (-) and all honeybee colonies nearly were the same strength under the same condition.

3. Measurements:

Evaluation was after twelve days, included, bee population, brood Area, and beebread area, and all areas measured using a typical longstroth frame divided into sq.inch, at 12days intervals.

Results and Discussion

1. Activities of bee population:

As a number of combs completely covered with honey bee worker. Statistical analysis from Table (1), showed that, no significant differences between all treatments from the beginning of evaluation at zero time read depend on replication similarity and colonies near the same strength. Slightly differentiation appeared after 24 days of treatments for worker population with no significant effect, with mean ranged from (6.17 to 7.33 combs covered with bees), during the first 5 or 6 days of adult life, worker bees consume large amounts of pollen to obtain the protein and amino acids required to complete their growth and development. A larva is regularly inspected by nurse bees and fed if necessary, so that it is always sufficiently provided with food (Robert and Karl, 2010), so after 36 days of treatments according to data of worker populations that depended on number of combs covered with honey bee workers gradually increased and recorded means 7.75, 8.00 and 8.69 for treatments FB.S., FB. 7gm/L, FB. 6gm/L and FB. 5gm/L, respectively, with no significant effects.

2. Brood areas:

If young adult worker bees do not consume needed proteins, their hypopharyngeal glands (brood food glands) will not develop completely, and their royal jelly will not support normal growth and

development of worker larvae or egg production in the adult queen. (Standifer *et al.*,1977). Highly significant effect appeared of brood areas using FEEDBEE® 5gm/L with mean 731.67 inch^2 after 12days and decreased significant with FEEDBEE® 6 and 7gm/L with means 538.33 inch^2 and 688.33 inch^{2,} respectively. FEEDBEE® substitute showed no significant effect with mean 464.00 inch^2. So, to improved honeybee physiological conditions its necessary addition of protein to the carbohydrate food (Perl'son, 1961).

On the other side, honey bees mix pollen with regurgitated nectar, honey and glandular secretions to produce bee bread, which differs from freshly collected pollen, in having a lower pH and less starch (Herbert and Shimanuki, 1978 and Ellis and Hayes, 2009). The shift in the quality of pollen stored in the colony (bee bread) is attributed to microorganisms associated with the honey bee (Gilliam, 1997). After 36 days of treatments according to data of brood areas highly significant effects showed in brood areas with concentrations 5 gm/L and 7gm/L with means 935.00 and 839.00 inch^{2,} respectively, less brood received only with carbohydrate diet (Standifer *et al*. ,1971). Followed by concentration FB. 6gm/L with mean 626.00 inch^2, finally, FB.S. was the lowest significant with mean 531.00 inch^2.

3.Stored pollen "Beebread":

In the colony, honey bees mix pollen with regurgitated nectar, honey and glandular secretions to produce bee bread, which differs from freshly collected pollen, in having a lower pH and less starch (Herbert and Shimanuki,1978 and Ellis and Hayes, 2009). Pasquale *et al.* (2013) found that both bee physiology and tolerance to a parasite varied depending on the type of pollen diet, suggesting that not only does the availability but also the quality of environmental resources matter. The shift in the quality of pollen stored in the colony (bee bread) is attributed to microorganisms associated with the honey bee (Gilliam, 1997). The basic principle of an artificial diet should be that it contains all the ingredients, texture, and consistency that are acceptable to the honeybees (Herbert and Shimanuki, 1979; Schmidt *et al*., 1987; Wilson *et al.*,2005 and Saffari *et al*., 2010). It must have nutritional values and be free from anti-nutritional factors (Schmidt *et al*., 1987; Herbert, 2000; Wilson *et al*., 2005 and Saffari *et al*., 2010). Vásquez and Olofsson (2009) suggested that lactic acid bacteria from the honey bee stomach belonging to the genera *Lactobacillus* and *Bifido bacterium* are involved in the fermentation process of beebread and may be responsible for improving the nutritive value by producing vitamins (Ellis and Hayes, 2009). More brood than those received only carbohydrate diet (Standifer *et al*.,1971).

Stored pollen at the first read showed not significant effect between all treatments and ranged from (34.00 to 89.00 inch^2), while low significant showed at the second read after 24 days and it recorded 19.67 inch^2 for the con. FB. 5gm/L,48.33 and 29.00 inch^2 for the con. FB. 7gm/L and FB.S., respectively, followed by 67.33 inch^{2}for the con. FB. 6gm/L against control 116.50 inch^2.

Table (1): FEEDBEE® effects on honey bee worker population "as a number of covered combs with workers, brood area and beebread area, reflacting of four concentration.

	Treatment	Zero time	1 st Read	2 nd Read	3 rd Read	Mean
worker population	**FEEDBEE® 5gm/L**	4.67[a]	5.33 [a]	7.33 [a]	8.69 [a]	6.51 [a]
	FEEDBEE ®6gm/L	4.67 [a]	5.33 [a]	6.17 [a]	8.00 [a]	6.04 [a]
	FEEDBEE ®7gm/L	4.83 [a]	5.50 [a]	7.00 [a]	8.00 [a]	6.33 [a]
	FEEDBEE®SUBSTITUTE	4.75 [a]	5.50 [a]	6.75 [a]	7.75 [a]	6.19 [a]
	control(-)	4.75 [a]	5.50 [a]	6.50 [a]	7.17 [a]	5.98 [a]
brood area	**FEEDBEE®5gm/L**	251.33 [a]	593.33 [a]	731.67 [a]	935.00[a]	627.83[a]
	FEEDBEE® 6gm/L	296.00 [a]	463.33 [a]	538.33[bc]	626.00[b]	480.92[bc]
	FEEDBEE® 7gm/L	386.67 [a]	570.67 [a]	688.33[ab]	839.00[a]	621.17[ab]
	FEEDBEE®SUBSTITUTE	330.00 [a]	445.00 [a]	464.00[c]	531.00[bc]	442.50[c]
	control(-)	407.50 [a]	511.50 [a]	500.00[c]	454.50[c]	468.38[c]
beebread area	**FEEDBEE® 5gm/L**	14.67 [a]	46.67 [a]	19.67[c]	22.12[c]	25.78[b]
	FEEDBEE® 6gm/L	51.67 [a]	89.00 [a]	67.33[b]	43.00b[c]	62.75[b]
	FEEDBEE® 7gm/L	28.67 [a]	43.00 [a]	48.33[bc]	58.00[b]	44.50[b]
	FEEDBEE®SUBSTITUTE	21.00 [a]	46.50 [a]	39.00[bc]	48.00b[c]	38.63[b]
	control (-)	15.00 [a]	34.00 [a]	116.50[a]	438.00[a]	150.88[a]

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), so stored pollen in the colony "beebread", while absent of protein source its stimulated colonies to gathered pollen to complete food chin for honey bee as a natural protein. Control recorded high significant effect than all treatments with mean 438.0 inch^2 after 36 days of FB. evaluation but the lowest significant effect recorded for powder FB. 5gm/L with mean 22.12 inch^2, and other treatments FB. 6gm/L, FB.S. and FB. 7gm/L ranged between 43.0, 48.0 and 58.0inch^2, respectively.

Generally, for three parameters; worker's population increased in evaluation time increased, but weren't significant effect it may will be appear next 12days. While in the brood areas data approved that concentration of FB. 5gm/L was the high significant effect with mean 627.83 inch^2, followed by concentrations FB. 6 and7gm/L with a few mortalities in bee feeder. While FB.S. showed low effective and beebread areas, showed low significant effect with FB.S. against control it may be related to colonies necessary needs. Obviously, there is an inverse relationship between increasing brood areas and beebread areas. Perhaps it related to specific requirement of amino acids for normal growth and development, reproduction, and brood rearing. The protein and amino acid requirements of larval and adult queens are unknown, but we have a fairly comprehensive knowledge of the chemical constitution of their basic food (Standifer *et al.*,1977).

Conflict of Interest

The present study was performed in absence of any conflict of interest.

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References

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

Chambers, S. (1990): Feeding pollens to honeybees for colony development. Bee World, 71 (1): 35-37.

Crailsheim, K.; Schneider, L.H.W.; Hrassnigg, N.; Bühlmann, G.; Brosch, U. and Gmeinbauer, R. (1992): Pollen consumption and utilization in worker honeybees (*Apis mellifera* L.): Dependence on individual age and function. J Insect Physiol, 38: 409–419.

Doull, K. M. (1980a): Relationships between consumption of pollen supplement honey production, and broodrearing in colonies of honeybees (*Apis mellifera* L.). J. Apidologie, 11 (4):361-365.

Doull, K. M. (1980b): Relationships between consumption of pollen supplement honey production, and broodrearing in colonies of honeybees (*Apis mellifera* L.). J. Apidologie, 11 (4):367-374.

Ellis, A.M. and Hayes , G.W. Jr (2009): An evaluation of fresh versus fermented diets for honey bees (*Apis mellifera*). J. Apic. Res., 48: 215–216.

Gilliam, M. (1997): Identification and roles of nonpathogenic microflora associated with honey bees. FEMS Microbiol. Lett., 155: 1–10.

Herbert, E. W. J. (2000): Honey bee nutrition, in Graham J. M. (Ed.). The Hive and the Honeybee. Dadant and Sons, *Hamilton Illinois*, 197-233.

Herbert, E.W. and Shimanuki, H. (1978): Chemical compositionand nutritive value of bee-collected andbee-stored pollen. Apidologie, 9:33–40.

Herbert, E.W.J. and Shimanuki, H. (1979): Brood rearing and honey production by colonies of free flying honeybees fed wheast and whey-yeast or sugar syrup. Am. Bee. J., 119: 833-836.

Mostafa, A.M. (2000): Influence of some supplementary feeding on physiological characters and productivity of honey bees. Ph.D., Assiut University, Assiut, Egypt, 230pp.

Parker, R. L. (1926): Tlie collection and utilization of pollen by the honey bee. Cornell Univ., Agr. Exp. Sta. Mem., 98:3-55.

Pasquale, G.; Salignon, M.; Le Conte, Y.; Belzunces, L.P.; Decourtye, A.; Kretzschmar, A.; Suchail, S.; Brunet, J. and Alaux, C. (2013): Influence of Pollen Nutrition on Honey Bee Health: Do Pollen Quality and Diversity Matter? PLoS ONE 8(8). 2013: e72016. doi:10.1371/ journal.pone.0072016 .

Peng, Y.S.; Marston, J. M. and Kaftanoglu, O. (1984): Effect of supplemental feeding of honeybee (Hymenoptera: Apidae) populations and the economic value of suplemental feeding for production of package-bees. J. Econ. Ent., 77:632-636.

Perl'son, L.E.(1961): The value of protein feeding . pchelovodstvo, 38(11):16-19.

Robert, B. and Karl, C. (2010): Nutrition and health in honey bees, Apidologie, 41: 278–294.

Rogala, R. and Szymaoe, B. (2004): Nutritional value for bees of pollen substitute enriched with synthetic amino acids part ii. Biological methods. J. Apicultural Science, 48(1):29-36.

Saffari, A.; Kevan, P. J. and Atkinson, J. (2010): Consumption of three dry pollen substitutes in commercial apiaries. J. Apic. Sci., 54(2): 13-20.

Schmidt, J. O.; Thoenes, S. C. and Levin, M. D. (1987): Survival of honeybees, *Apis mellifera* L. (Hymenoptera: Apidae), fed various pollen sources. Ann. Entomol. Soc. Am., 80: 176-183.

Somerville, D.C. and Nicol, H.I. (2006): Crude protein andamino acid composition of honey bee-collectedpollen pellets from south-east Australia and a noteon laboratory disparity, Aust. J. Exp. Agr., 46:141–149.

Standifer, L. N.; Moeller, F. E. and Kauffeld, N. (1977): Supplemental Feeding of Honey Bee Colonies. United States Department of Agriculture. Information Bulletin, 413: 8.

Standifer, L.N.; Waller, G.D.; Haydak, M.H.; Levin, D.M. and Mills J.P. (1971): Stimulative feeding of honey bee colonies in Arizona. J. Apic. Res., 10(1):27-34.

Vásquez, A. and Olofsson, T.C. (2009): The lactic acid bacteria involved in the production of bee pollen and bee bread. J. Apic. Res., 48:189–195.

Wille, H. and Schafer, H. (1970): Feeding trials using a liquid pollen substitute. Schweiz. Bienenztg, 93(10): 483-494.

Wilson, G. P.; Church, D. C.; Pound, K. R. and Schoknecht, P. A. (2005): Basic animal nutrition and feeding, 5th edition, John Wiley and Sons. Hoboken, NJ USA.