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Effect of Some Pollen Substitute Diets on the Development of *Apis mellifera* L. Colonies

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Abstract: Nine pollen substitute diets were tested for their performance in supporting the bee colonies of *Apis mellifera* L. during summer 1996. Maize flour + Vitamin B-complex + Glysine (T_6) proved the most suitable diet with 416.14 square inches brood area recorded in the hives provided with this diet. The next more preferred diet was Maize flour + Vitamin B-Complex + Egg yolk (T_4) with 354.81 sq. inches brood area. In case of pollen area, the diet T_1 (Soybean flour + Vitamin B-Complex) proved the most effective with 104,90 square inches and it was statistically better than all other treatments. Maximum honey area (195.79) square inches recorded in colonies fed with Maize flour-4-Vitamin B-Complex + Methionine (T_8) and it was better than all other treatments. Maximum colony strength of 6.24 bee frames per colony was observed in the colonies fed with T_7, (Soybean flour + Vitamin B-Complex + Methionine) and it was statistically similar to T_8 (5.931, T_9 (5.78), T_1 and T_4 (5.74).

Key words: Pollen Substitute, *Apis mellifera*

Introduction

As during summer the natural sources of pollen and nectar remain scarce, the ornamental plants do not bear flowers during this season while the available agricultural crops like cotton, rice etc. are frequently sprayed with very toxic insecticides which are very injurious to honeybees. Due to these reasons, in summer, the bees are supplemented with artificial diets. So it is intended to initiate efforts to enhance the brood rearing activity of bees during summer by providing them pollen substitute diets. Therefore, the present investigations are being taken with major objective to evaluate the best suitable pollen substitute for summering the bee colonies and to improve their performance of brood rearing. The previous workers also did some work on these aspects such as:

Latif *et al.* (1956) reported that during various pollen scarcity periods, soybean flour and natural pollen (3.2) gave an increased brood rearing.

Kashkovskii and Shushkov (1963) tested two groups of colonies and found that feeding bees with honey mixed with pollen did not influence the amount of brood reared.

Mores and Laigo (1968) observed a variety of suggested pollen supplements and found the best supplement prepared from four parts of Soybean flour, one part dried Brewer's yeast and one part dried skimmed milk. Bambay and Gorgui (1970) observed that the Maize flour proved significantly better than other flours. Stanger and Gripp (1972) reported that the colonies fed with pollen supplements, increased in bee population. Erickson and Herbert Jr (1980) reported that Soybean products were satisfactory substitute for expeller-processed Soya flour when fed with pollen supplement.

Rafique and Nasreen (1984) reported that during pollen scarcity period, provision of sugar and honey syrup and mixture of dried egg yolk and soybean flour gave good results for colony development.

Farooqi (1986) studied the nutritional affects of different feeds on the development of *Apis mellifera* L. colonies. Among the 10 treatments, the most significant diet was found to be pollen as best substitute diet.

Garcia *et al.* (1986) determined that the synthetic diet, composed of Soya and Maize added with methionine and lysine increased the viability of eggs produced by the queens and food intake in the hives.

Couto *et al.* (1989) studied the effects of feeding with a diet containing 53 percent Soybean meal 27 percent wheat meal and 20 percent maize on the production of food and brood. They also observed that this diet did not stimulate queen oviposition and brood rearing.

Materilas and Methods

The experiments were conducted in the Apiary of Department of Agricultural Entomology, University of Agriculture, Faisalabad, following Completely Randomized Design (CRD). Thirty colonies of *Apis mellifera* L. in the standard Langstroth bee hives, having queens of the same age were selected. These were divided into ten groups, each comprising three colonies. Each group was of equal strength. The colony groups were randomly selected for each diet and each colony was numbered and labelled. The following feeds were tested during the course of the studies carried out during the summer, 1996. The data recorded were subjected to the statistical analysis.

T_1	Soyabean flour + Vitamin B-complex.
T_2	Maize flour + Vitamin B-Complex.
T_3	Soyabean flour + Vitamin B-Complex + Egg yolk
T_4	Maize flour + Vitamin B-Complex + Egg yolk
T_5	Soybean flour + Vitamin B-Complex + Glysine
T_6	Maize flour + Vitamin B-Complex + Glysine.
T_7	Soybean flour + Vitamin B-Complex + Methionine
T_8	Maize flour +Vitamin B-Complex + Methionine
T_9	Pollen
T_{10}	Control

Pollen was collected mechanically from bee combs and soybean flour prepared by extracting oil from soybean grains. Each diet was prepared by mixing its ingredients with sugar syrup 11:21 in dough-like consistency (Rafique and Nasreen, 1984).

The diets used to evaluate the brood rearing capabilities of test colonies were placed on the top of the frames in bee hives and colonies *were* fed continuously on these diets.

One group of these colonies served as control. Sealed brood area was measured in square inches after every two weeks by means of a wire grid with divisions giving an area of one square inch each. This sealed brood was used as criteria for judging the development of colonies. The pollen and honey area was also recorded with the same method as mentioned in brood area. The number of frames stored in hives were also checked and recorded.

Results and Discussion

The results obtained during the course of study are given in Fig. 1. The perusal of the table show that in diet T_6 proved the most suitable with maximum brood area of 416.14 sq. inches was

recorded. The next preferred diet was T_4. The brood area observed in this case was 354.81 square inches and it was also statistically better than all other treatments except T_6. The poorest performance was showed by the diet T_5 with 217.76 and it was statistically similar to T_3 (231.57), Minimum brood area was recorded in control (160.31) and it is statistically inferior to all other treatments. The results about pollen area show that the maximum pollen area 104.99 square inches was observed in diet T_1 and it was statistically better than all other treatments, with pollen area ranging from 37.80 to 78.38 square inches. T_4, T_5, and T_9 also gave good performance as pollen substitute and the pollen area recorded were 78.38, 78.12 and 74.71 respectively and these three treatments were found statistically at par. Minimum pollen area was recorded in control which was only 37.78 square inches.

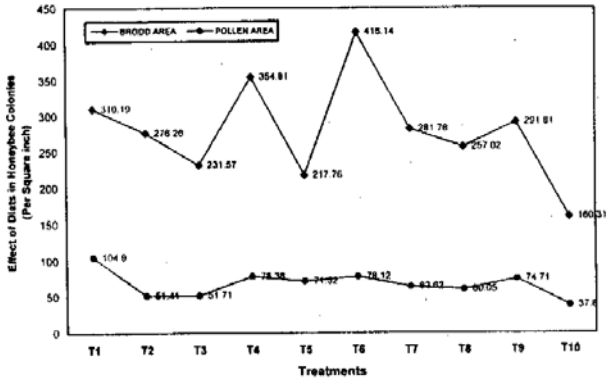

Fig. 1: The effect of different diets on brood and pollen area (per square inch) in *Apis mellifera L.*

The results in Fig. 2 about honey area depict a significant effect on honey area by the diet T_8 with the maximum honey area of 195.79 square inches and it was statistically better than all other treatments. T_9 also proved very good and 173.38 square inches honey area was observed in this case. T_2, T_3 and T_5 showed similar effects on honey area ranging from 46.28 - 51.78 square inches. T_{10} had 37.19 square inches honey area and it was statistically inferior to all other treatments. The maximum bee strength of 6.24 frames was observed in colonies fed with T_7 and it was statistically at par with T_9 (5.93), T9 (5.78), T_1 and T_4 (5.74) while T_2 (5.64) proved better than T_3 (5.16), T_5 (5.09) and T_{10} (5.09).

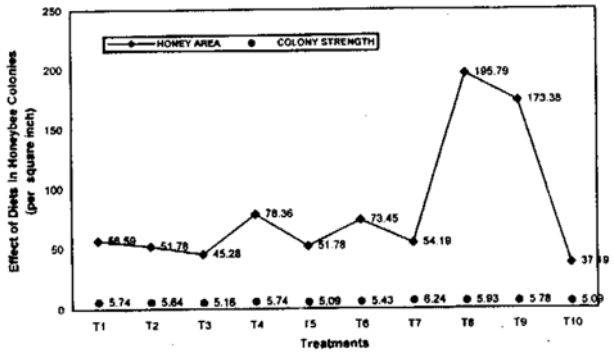

Fig. 2: The effect of different diets on brood and pollen area (per square inch) in *Apis mellifera* L.

Similar results were obtained by Bambay and Gorgui (1970) and Garcia *et al.* (1986) who reported that maize flour proved more significantly better than other flours as a pollen substitute. Partially similar results were obtained by Latif *et al.* (1956) when they mixed egg yolk, honey and natural pollen. These results are also different from those of Mores and Laigo (1968), Rafique and Nasreen (1984) and Farooqi (1986) who reported that soybean mixed with different other substances proved good pollen substitute.

In case of pollen area results are comparable with those of Erickson and Herbert Jr (1980) who reported that soybean products were good substitute as pollen supplement.

The results about honey area are in agreement with those of Farooqi (1986) and Couto *et al*. (1989) who reported positive and increasing effect of different pollen substitutes/ supplements on honey area.

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