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INFLUENCE OF SUPPLEMENTAL DIETS ON *APIS MELLIFERA* L. COLONIES FOR HONEY PRODUCTION

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ABSTRACT:- Four pollen supplemental diets were tested for their performance in supporting the bee colonies of *Apis mellifera* during August, 2011 and January, 2012 in the premises of Honey bee Research Institute, National Agricultural Research Centre, Islamabad, Pakistan, to investigate alternative nutrients to pollen grain. Sixteen *A. mellifera* bee hives were selected alike with respect to number of frames and bees present in them. Honey bee colonies were divided into four groups of four colonies each. The honey extracted from the T_1 (soybean diet), T_2 (gram diet), T_3 (maize diet) and T_4 (sugar only) was 21.3 kg ± 0.22, 24.4 kg ± 0.29, 19.3 kg ± 0.11 and 16 kg ± 0.11 respectively. The honey produced after the treatment of pollen with gram (T_2) was significantly better than that produced by the bees fed on other pollen supplemental diets. There was no significant difference for royal jelly production.

Key Words: Gram; Maize; Soybean; Pollen; Diets; Honey Bee; Pollen Substitute; Pakistan.

INTRODUCTION

Pollen grains are the male germs of flowers, rich in high quality protein, which serves as the building material for growth and tissue repair to honey bee colonies (Somerville, 2000; Alghamdi, 2002; Mishima et al., 2005). Pollen grain also has a role in the production of royal jelly, produced for the queen bee (Alqarni, 2006). The demand for pollen increases during times of heavy wax production and honey flow (Somerville, 2000).

An average colony consumes 15-30 kg pollen per year (Seeley, 1985). Worker bees start to consume pollen just a few hours after emerging and this amount reaches a maximum when the bees are four to nine days old (Crailsheim et al., 1992).

During the shortage or complete absence of pollen, or in the presence of only poor quality pollen, beekeepers often feed colonies of honeybees with either pollen substitute (with no pollen) or supplement (with pollen) diets. These are ideal materials that provide required nutrients to bees (Saffari et al., 2004; Zahra and Talal, 2008).

Pollen supplement diets containing 20% or more of either soybean flour or brewer's yeast are highly palatable to bees and have the nutritive requirements for their growth and reproduction (Mattila and Otis, 2006). The pollen substitute diet and pollen are equally accepted by the bees. The pollen substitute diet is

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thus, as highly palatable as natural pollen and easily provided as patties to colonies in standard hives (Saffari et al., 2004). Beekeepers feed colonies to stimulate brood rearing in the late winter or early spring, or to relieve dietary stress during times when adequate pollen from blooming plants is not available or is of marginal nutritional value (Mattilla and Otis, 2006; Nabors, 2000).

The purpose of this study was to find out the supplemental diet during the dearth period in honeybee colonies for the production of honey.

MATERIALS AND METHOD

The experimental work was carried out at Honeybee Research Institute, National Agricultural Research Centre, Islamabad, Pakistan on 16 queen right *A. mellifera* colonies during the dearth period (August, 2011 - January, 2012). All the selected colonies had six month old queens with good egg potential and workers strength. Honey bee colonies of each group that had been standardized one week before, on the basis of five bee and two brood frames. Colonies were placed at 5m distance from each other. Selected honeybee colonies were numbered, labeled and divided into 4 groups following Completely Randomized Design (CRD) with four replications. In this study pollen supplemental formula was used (Standifer et al., 1977). The following treatments were used.

T_1 = Pollen supplemental soybean diet 250 g per colony + brewer's yeast + sugar supplemental feeding.

T_2 = Pollen supplemental gram diet 250 g per colony + brewer's yeast + sugar supplemental feeding.

T_3 = Pollen supplemental maize diet 250 g per colony + brewer's yeast+ sugar supplemental feeding.

T_4 = Sugar supplemental feeding (only sugar).

The pollen supplement diet as moist patties was prepared for feeding inside the hive by first dissolving the pollen pellets in water. Then, stirred in the sugar until it dissolves or is well mixed with the pollen. Finally, flour was added to the water-pollen-sugar mixture and stirred thoroughly. The bulk supplement (patties) was placed in waxed paper to prevent moisture loss. The patties were spread on wax paper and put on the top bars in the hive. The tested bee colonies were fed on 15 day interval during the experimental period (Standifer et al., 1977). The colony was provided with a new supplemental patty before the entire previous patty was consumed. The diet (patties) was given to bee colonies on August 4 & 19, September 3 & December 22, 2011 and January 19, 2012. Data on honey yield and royal jelly production was recorded. For Royal jelly production, worker bee larvae (less than 48h) old were grafted into plastic queen cups. A small amount of royal jelly was applied to the bottom of each queen cup with a paint brush before grafting. Each queen cup bar consists of 30 grafted cups. After grafting the larvae in cups on two bars of the frame, this frame was placed between two sealed-brood combs and one pollen frames in March 2012. The grafting frame containing queen cups, was then filled with royal jelly by bee workers

and larvae. After 48h, royal jelly cups frame was removed from the colony. Larvae were removed with the forceps and royal jelly collected by a flat bamboo spoon.

Honey Yield

Honey was harvested after experiment with the help of manual honey extractor. Honey production was measured by taking the weight of each hive body used for honey collection before and after the honey extraction process. The weight difference was considered as the amount of harvestable honey (Rashid et al., 2012).

Statistical Analysis

All data recorded during the study were analysed by using computer based software MSTAT C (Freed and Eisensmith, 1986). Analysis of variance techniques were applied to test the significance of data using least significance difference test (LSD) at 5% probability level (Montgomery, 2001).

RESULTS AND DISCUSSION

The honey extracted from the T_1, T_2, T_3 and T_4 was 21.3 kg ± 0.22, 24.4kg ± 0.29, 19.3kg ± 0.11 and 16kg ± 0.11, respectively. It is evident that for honey yield application of the gram supplement diet induced the maximum (24.4kg ± 0.29). T_2 (gram supplemented diet) produce significantly high honey yield when compared to the other test treatments (Figure 1). On the other hand, application of pollen supplemental of soybean or the maize diet both produced high honey yield as compared to only sugar supplemental treatment.

In royal jelly season weather conditions (March-April, 2012) were not favorable for grafting of royal jelly cells. Therefore royal jelly production from T_1, T_2, T_3 and T_4 was only 7g ± 0.34, 8g ± 0.29, 7g ± 0.17 and 6g ± 0.15, respectively (Figure 2). There is no significant difference for royal jelly production in all treatments.

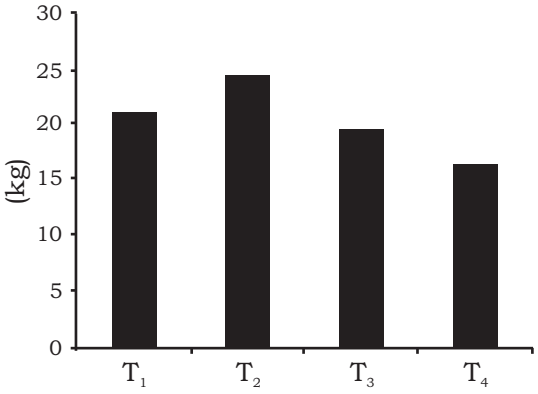

Figure 1. Mean honey yield (kg) from colonies treated with different food supplements

The feeding of pollen supplement improved the income and honey yield of beekeepers as reported earlier by Shah and Shah (1979), Sheeley and Poduska (1968) and Mladenovic et al. (1999). Musa et al. (1989) have used brewer's yeast, soyaflour, molasses, skimmed milk powder as pollen substitute and reported an increase in honey production by the colonies.

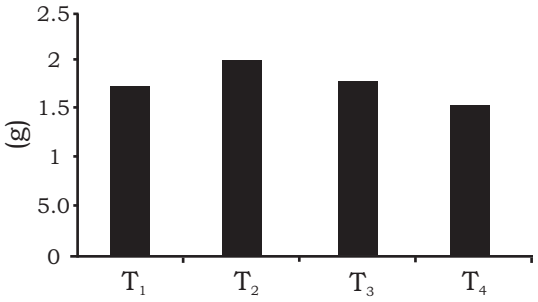

Figure 2. Mean royal jelly (g) produced from colonies treated with different treatments

The results are in conformity with Tahir et al. (1995) who concluded that flour of black gram was used instead of soybean as a substitute for pollen in the diet of honey bees. The colonies which were fed with pollen substitute containing black gram produced higher honey compared with those fed on meal containing soybean. The results are also agreed with Abusabbah et al. (2012) who found that percentage of honey produced after treating pollen with yeast and chickpea with yeast was found significantly better than that produced by the bees fed on maize flour and pollen. The results are also in agreement with those of Abdel-Latif et al. (1971); Mladenovic et al. (1999) and Kalve et al. (2002) who found that feeding bees with brewer's yeast as pollen grains substitute increased honey production.

It is thus concluded that honey bee colonies provided with supplemental gram diet (T_2) gave highest honey yield 24.4kg ± 0.29 while control (T_4) produced the lowest 16kg ± 0.11. Gram diet (T_2) produced significantly high honey yield. There is no significant difference for royal jelly production. Gram supplemental diet with pollen is recommended to be a good substitute for pollen grains during the dearth period.

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