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Comparative Value of Pollen and Pollen Substitutes

*I. Bee Bread and Cottonseed Meal–Dry Skim Milk Mixture**

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In the previous articles on the value of pollen substitutes (Haydak 1933, 1936, 1937) the author has paid attention almost exclusively to the question of whether any given food substance can replace pollen as a food for bees. Little emphasis has been placed on the exact comparative value of pollen and pollen substitutes studied, except in the first publication. From those investigations an impression might have been gained that those substances which bees can utilize as food are inferior to pollen as stored by the bees. One has to remember, however, that the control colonies in the previous experiments were given bee bread in a natural undiluted state, while the experimental colonies were given mixtures of the dry food and honey in proportion 1:4 to 1:7. Under such circumstances the qualitative and quantitative differences which were observed in the experiments might have been due to the fact that the bees fed pollen actually consumed more food per volume intake than did the bees fed pollen substitutes and therefore showed a better physiological performance.

For an evaluation of the nutritive value of any food substance the food intake of the experimental animals must be equalized. In case of bees where any restriction in food brings a certain reaction of the colony as a whole (restriction of egg laying, change in the rate of brood rearing activity), such equalization may bring additional factors which may make very difficult the interpretation of the results obtained. Therefore it was decided to feed the experimental colonies *ad libitum*, but to equalize the percentage of food per volume intake. The amount of food given to the experimental colonies was noted.

METHODS.—The method and the procedure of the present experiment did not substantially differ from those described previously (Haydak 1937). It was found, however, that an addition of a laying queen during the first day simultaneously

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with the second brushing of emerged bees into the experimental hive tends to quiet the bees and makes the whole procedure of an addition of new bees simple and easy. Young bees were not brushed directly into the hive, but into a glass container through a bee funnel, similar to that which is used in the bee package industry. The container with the bees was then weighed and the bees poured into the hive. In such a way the number of bees in the colonies was to a certain degree equalized.

Since it was established that the growth curves representing the increase in the dry weight and nitrogen content for adequate foods follow each other quite closely (Haydak 1937), only the dry weights of the thoraces of the experimental bees were ascertained.

FOODS.—Clumps of bee bread as taken from the cells of a comb were used; 50 grams of bee bread were mixed with 20 cubic centimeters of water to make a paste; then 200 grams of honey were added and all the ingredients were thoroughly mixed in a mortar. Bee bread of 1933 (5 years old) and of 1937 (1 year old) was used in the experiment. Both samples were stored in a refrigerator.

Sifted cottonseed meal was mixed with dry skim milk (spray process) in the ratio 4:1 by weight. Forty grams of this mixture were mixed with 200 grams of honey, and 20 cubic centimeters of water were incorporated into the mixture. The dry weight of both foods was the same.

Foods were distributed to the cells of a comb and given to the experimental colonies in the usual manner. Three colonies were used for the testing of each food. One colony in each group received a dry food–commercial invert mixture (*Nulomoline* brand).

RESULTS AND DISCUSSION.—Table 1 gives a summary of the results of the experiment. Except for the percentage of mortality, only the average of two colonies was used. This was done because one colony in each group did not rear brood. One of the colonies fed bee bread–honey mixture did not start brood-rearing although for 27 days eggs were present in the cells. Bee bread of 1933 was used for the food mixture. Another colony which was simultaneously fed bee bread of the same age from the same jar started brood-rearing and carried it to completion. In this case the bee bread was mixed with commercial invert.

Table 1.—Composite results of feeding bee bread and cottonseed meal–dry skim milk mixture.

Food	Total Number of Bees	Development of Bees (Weight of Thoraces in Milligrams)					Percentage Mortality	Food Consumption in Grams	Number of Days in Which Brood Rearing Started After Queen Was Added	Number of Sealed Cells and Larvae Before Sealing	Dry Weight of Emerging Bees in Milligrams
		Emerging Bees	2 Days Old	4 Days Old	5 Days Old	8 Days Old					
Bee bread	8,459	9.1	11.4	12.0	13.0	13.3	25.6	606	13	321	15.3
Cottonseed meal–dry skim milk food	9,608	9.1	10.9	11.8	12.6	13.2	33.6	490	9	391	15.5

The cottonseed–commercial invert fed colony did not start brood-rearing, although for 21 days eggs were present in the colony. In both cases fertile queens whose good performances in the colonies have been known were used. It is hard to explain these fact on the basis of our present knowledge of bee life.

Examination of the table shows that there was practically no difference in the results obtained. The development of the bees proceeded normally. The behavior of all the colonies was about the same. The brood-rearing activity was started several days later in the pollen-fed colonies and the consumption of food in the latter was higher than that in the pollen substitute-fed colonies. However, the average mortality in the latter group was somewhat greater. In neither group did the brood cells form a compact mass. In this case pollen-fed colonies differed considerably from those in the preceding experiment when the sealed brood cells in the pollen-fed colonies formed a compact mass as under natural conditions (Haydak 1937). The young bees reared by the experimental colonies were of almost the same weight. However, their weights were lower than those of the young bees in the previous experiments.

When combs with sealed brood were re-

moved from the experimental colonies, the bees continued their brood-rearing activities without an interruption as they would do under normal conditions.

SUMMARY AND CONCLUSION.—A comparison has been made between the pollen as stored by bees in the cells and cottonseed meal–dry skim milk mixture. The food was prepared in such a manner as to make the ingestion of pollen and the food substance investigated equal per volume intake. Three colonies have been used for the testing of each food. One colony in each group did not start to rear brood at all. No adequate explanation has been found for this phenomenon. The rest of the colonies started brood-rearing and carried it to completion.

The results of the experiment indicated that there was practically no difference in the nutritive value of the bee bread and the cottonseed meal–dry skim milk mixture as judged by the development of bees, number and quality of the bees reared and the mortality of the experimental bees.—1-6-39.

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