VITAMINE STUDIES. III.

OBSERVATIONS ON THE CURATIVE PROPERTIES OF HONEY, NECTAR, AND CORN POLLEN IN AVIAN POLYNEURITIS.*

By R. ADAMS DUTCHER.

With the Cooperation of L. V. France, Division of Bee Culture.

(*From the Laboratory of Agricultural Biochemistry, Minnesota Agricultural Experiment Station, St. Paul.*)

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INTRODUCTION.

Since the United States Food Administration first showed the necessity of conserving the available supply of cane and beet sugar, much has been written to show that one way to conserve sugar would be to encourage consumption of larger quantities of syrups and honey. Much of the printed matter is designed for the general reader and, of course, many extravagant statements have been made, some of which have not accomplished the purpose for which they were written, but in the main, much real good has been attained.

In extolling the virtues of honey some writers in the past have pointed out that, although honey is not as economical as commercial sucrose, it is superior to ordinary sugar on account of its laxative action, fuel value, and medicinal properties. More recently honey producers have been asking whether honey contains vitamines. Inquiry shows that statements in the affirmative have been made in popular articles, but we have been unable, up to the present time, to find any record of investigational work in this field.

On account of the importance of this question at the present time, we have conducted experiments, which will be described

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later, attempting to prove or disprove the presence of vitamines in honey.

A study of the habits of the honey-bee shows that there are, generally speaking, two types of food used by the bee, floral nectar and pollen. The floral nectar is brought to the hive in the honey stomach of the bee and deposited in the cell where it is evaporated later to honey. Most of the pollen is carried from the flower to the hive in the pollen baskets or corbicula situated on the tibiæ of the third pair of legs (1); it is also transported to a much lesser degree by clinging as a dust to the body hairs. This pollen is moistened and packed into certain cells and is known as bee bread. Unpublished data in this laboratory indicate that the pollen is probably moistened with nectar or diluted honey. It is from this bee bread and honey that the larval food of the future generations is prepared.

In planning the experimental work it was felt that, should honey contain vitamines, there would be a greater possibility of finding the water-soluble vitamine in honey than its fat-soluble prototype, due to the very nature of honey which is high in water-soluble substances but low in fatty materials.

It was first pointed out by McCollum and Kennedy (2) and later corroborated by Drummond (3) that the substance found in seeds, seed embryos, thin leaves of plants, and potato juice, which cured avian polyneuritis and assisted in the general well being of growing animals, is probably one and the same substance. This has been called "water-soluble B." It was with the view of studying honey with reference to this vitamine that the following experiments were conducted.

EXPERIMENTAL.

The honey used in this experiment was a clear sample of strained honey obtained while basswood and white clover were in full bloom. The nectar was obtained largely from white clover, although basswood was in bloom at the time but was not being visited by many bees. This material was obtained by centrifuging the uncapped combs, newly filled with nectar, before time had elapsed for evaporation to take place. Our reason for using nectar was to study the effect of evaporation and "ripening" of honey upon its vitamine content, should vitamines be found to be present.

Microscopical examination of the nectar and honey showed a few grains of pollen to be scattered through the mass. Consequently it was thought that the water-soluble vitamine content of pollen should be taken into consideration also. Fortunately there were available for this work several pounds of corn pollen which had been collected for other experimental projects in this laboratory. It was assumed that corn pollen would be representative of other pollens in this regard and therefore it was used because of the quantity easily available.

On June 29, 1918, fifteen pigeons were placed on a diet of polished rice and these were fed, watered, and weighed in the same manner as those in preceding experiments (4). Pigeon 26 became polyneuritic on the 20th day of rice feeding and was fed about 20 gm. of basswood-clover honey (diluted) at about 9.30 a.m. At noon on the same day the bird was found dead. Similar results were obtained when Pigeon 27 became polyneuritic on the 22nd day, except that the bird did not die so quickly as Pigeon 26.

Funk and von Schönborn (5) have advanced the hypothesis that vitamines have a distinct effect on carbohydrate metabolism, and Vedder and Clark (6) are of the belief that fowls with high metabolic activity require larger amounts of vitamines and succumb more promptly to diets of polished rice.

Theiler and his coworkers (7) and Braddon and Cooper (8) found that forced feeding brought on the disease much more quickly than when the pigeon was allowed to starve itself partially. Our work is in agreement with this.

It would appear, therefore, that Pigeons 26 and 27 might have died because of overloading of the oxidative mechanism during a low vitamine feeding. Seidell (9) and Emmett and McKim (10) have shown that vitamines are adsorbed upon colloidal suspensions of siliceous earths, and this method has been used by them to separate the vitamines from other materials. With this in mind, 2 pounds of basswood-clover honey were dissolved in water and shaken for about an hour with Lloyd's reagent,[1] after which the siliceous earth was filtered and washed until it was no longer

[1] This highly adsorptive siliceous earth was generously supplied by Professor Uri Lloyd of Cincinnati.

sweet to the taste. This paste was transferred to a graduated flask and made to 200 cc. volume with water. 10 cc. portions, representing 45 gm. of honey, were fed at each feeding when needed.

Pigeon 23 showed symptoms of polyneuritis on the 19th day and was fed 10 gm. of honey in the morning. By 3 o'clock in the afternoon the bird was acutely polyneuritic with the head drawn over its back. At 5 o'clock the same afternoon a 10 cc. portion of the Lloyd's preparation from honey was administered. The next morning the pigeon was walking weakly about the cage. Toward evening the bird was much stronger, at which time another 10 cc. portion of the preparation was fed. Thereafter ground rice was fed daily with a 10 cc. portion of the Lloyd preparation, and no particular change could be noted. The bird remained on its feet but walked with difficulty. After 10 days a small amount of vitamine extract of wheat embryo was fed to this pigeon and recovery was immediate, showing that the vitamine content of the honey was relatively low compared to that in the embryo of wheat.

Similar results were obtained on Pigeon 20, with the Lloyd preparation from honey, except that the curative properties of the preparation were even less evident than in the case of Pigeon 23.

The vitamine from 2 pounds of nectar was adsorbed on Lloyd's reagent, and made to 200 cc. volume. In this case also, 10 cc. represented 45 gm. of nectar. This preparation was fed to Pigeons 13, 16, 17, 18, 21, and 22 as soon as they became polyneuritic. The pigeons were forcibly fed as soon as they refused the polished rice.

We were unable to see improvement in any of the birds receiving the nectar preparation; all birds so treated died almost immediately or were cured by changing from this diet to one high in water-soluble vitamine.

The vitamine extract from the pollen was a dry powder prepared by extracting pollen in hot 50 to 65 per cent alcohol and evaporating this on dextrin at a relatively low temperature over a steam-heated sand bath in the air current from an electric fan.

Without going into detail regarding the efficiency of the vitamine extract prepared from corn pollen, it is sufficient to say that all polyneuritic birds which received this preparation recovered very quickly. In the case of Pigeon 15 we were able to bring on symptoms of polyneuritis three successive times and then to

cause the symptoms to disappear each time by a pinch of the pollen extract. Pollen extract was also fed to Pigeons 16 and 18 which were dying, due to the lack of vitamine in the Lloyd preparation from nectar. In both of these cases the pigeons improved sufficiently to fly to their perches within 36 hours.

CONCLUSIONS.

Honey contains a small amount of water-soluble vitamine, but the amount is negligible. It is probable that the slight antineuritic properties of honey are overbalanced by the large amount of carbohydrate present, for the presence of vitamines was made evident only upon removing the sugars by adsorbing the vitamines upon siliceous earth. There was very little evidence of the presence of water-soluble vitamine in the dilute unevaporated nectar. Corn pollen is relatively rich in water-soluble vitamine and it is possible that the small amount of this in honey may have its origin in the pollen of flowering plants, either in the form of pollen grains adventitiously present, or in the digested products, which might be introduced by the salivary juices of the bee.

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