

From Gleanings.

Microscopic Tests of Honey—Are They Infallible?

FRIEND COOK RENDERS IMPORTANT SERVICE IN ANOTHER SERIOUS CRISIS.

FREND Root:—Your inquiry in reference to the reliability of the scientific tests for honey is very opportune. I made, the past winter, in revising my book, a careful investigation of this whole subject, and I am led to doubt the existence of a sure test for honey, either chemical or by aid of the polariscope. As you doubtless know, there are two kinds of sugars—cane, and the glucose group, or reducing sugars. The latter are so called because they reduce the copper sulphate, when made strongly alkaline by the addition of caustic potash. Of the reducing sugars, we have the glucose of our factories, honey, liver sugar, digested starch, or the sugar of digestion, etc. The chemist using the copper test as given above calls all these sugars identical, simply because they give the same reaction with the copper sulphate. I don't believe they are the same. If so, why will bees forsake common commercial glucose for honey?—or why will they die on the purest commercial glucose, and thrive on good honey? Cane sugar will not reduce the copper salt; and when eaten by animals it must be digested and assimilated. Thus when we eat cane sugar we do what the bees do with nectar—we convert it into a reducing sugar, very likely the same as honey.

As will be seen by the above, nectar contains cane sugar. Indeed, the cane sugar in nectar often equals in amount all the other sugars put together. Analyses show, however, that the amount of this cane sugar in nectar varies. Let this be remembered: *The amount of the different sugars varies in the nectar of different flowers.* Again, as the bee sips nectar it is mixed with the secretion from the racemose glands of the head and thorax; and this acts like our own digestive secretions on the cane sugar, and changes it to reducing sugar. Now, suppose the bees are gathering very fast from the basswood, for instance, where a single colony may gather over 20 lbs. per day, does it stand to reason that they can digest this nectar as perfectly as though they were gathering from some source where they secured their stores in mere dribblets? Thus in such cases of very rapid gathering the digestion would be less perfect, and the honey would contain much cane sugar. May this not account for the marked sweetness of basswood honey? In this connection it is suggestive that, in the various analyses which have been made of

honey, the amount of cane sugar varies. Thus I find the analyses generally give from one to three per cent., while in some cases even twelve and sixteen per cent. of honey has been found to be cane sugar. *Here, then, mark the second uncertainty. Owing to the more or less rapid gathering, the digestion of nectar is more or less perfect.* The chemist, then, would find much cane sugar, and would report adulteration, when the honey was entirely pure, right from the bees, and through them from the flowers; but owing to imperfect digestion the cane sugar was very prominent. Such honey would be much sweeter than though more reduced, or digested, and so have higher intrinsic value.

We see, then, that the chemist can not tell us absolutely whether honey is adulterated or not. There is reason to believe that absolutely pure honey has been pronounced as probably adulterated. The chemist was honest and able, but did not understand the whole question or its many difficulties.

But what of the polariscope test? This test depends on the property of various substances to deflect the rays of polarized light to the left or right. Thus, cane sugar changes the rays of polarized light to the right; so does dextrose, one of the reducing sugars of honey. On the other hand, lævulose, one of the elements or sugars of honey, bends the ray strongly to the left. Dextrose and lævulose are often called invert sugars; for when cane sugar is heated with a mineral acid like hydrochloric it is changed to dextrose and lævulose. Dextrose and lævulose are obtained from fruit as well as from honey. Glucose is a term used to designate all the invert or reducing sugars, and is exactly synonymous with grape sugar.

Now, usually honey rotates the ray of light, owing to the lævulose, from two to twelve degrees to the left. FROM TWO TO TWELVE. Are not these numbers very suggestive? In the first case, two degrees; there was likely much dextrose, possibly aided by not a little cane sugar or sucrose; while in the latter case the lævulose was in the ascendancy. Now, suppose the ray bends wholly over to the right. "Hey ho!" says the scientist—"adulteration!" when, in fact, it was pure honey; but the cane sugar and dextrose are still more pronounced. Surely, if the ray often varies from two to twelve, left-handed rotation, we may certainly believe it will often show a right-handed deflection. I fully believe that we have had as yet no reliable methods to detect adulterations.

I am very certain that adulteration is never practised by bee-keepers, and is very rarely practised if at all in these days, by dealers. This opinion is not a mere guess, but the result of extended inquiry.

A. J. Cook.

Agricultural College, Mich.