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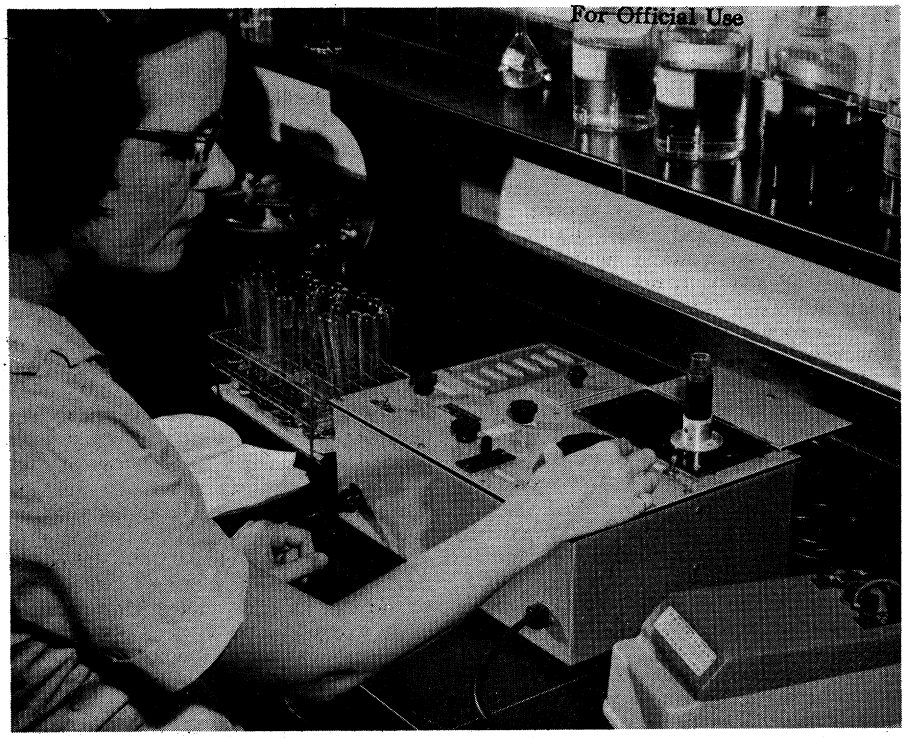

Using the new Schade method, Mary Subers determines the diastase number of honey with the photoelectric photometer. — A USDA photo.

A Survey of American Honeys

Number nine in a series of ten articles on the different honeys of America.

9. Effect of Storage on Diastase Content [1/]

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1/ This is one in a series of articles describing a large-scale study of the composition of honeys from over the United States. Complete data interpretation and conclusions will appear in a forthcoming Department of Agriculture publication.

DIASTASE (or more properly, amylase) is an enzyme that "digests" starch. It has long been known to occur in honey. Its function in the ripening of honey is not clear, nor is it known with certainty if it is introduced by the bee or arises from a plant source (nectar, pollen, yeasts, etc.). Conceivably, diastase in honey could arise from all those mentioned. Periodic interest is shown in this country in the diastase content of honey; it arises when European importers refuse honey shipments or downgrade them because they find low values of diastase in samples.

It is thought in some European countries that honey loses much of its nutritive or protective value when it is heated. Since the enzyme is destroyed or weakened by heat, and is fairly easy to measure, the presence of certain amounts of diastase have been used for many years as assurance that honey has not been heated excessively. There have been some differences of opinion on whether a honey may have a low diastase value, but still be an unheated honey. There is no doubt that some types of honey produced in this country are so low in diastase as to not meet European requirements, even though they had never been heated. This, and other evidence that showed variable effects of heating on diastase content, have led to modification of import reglations in West Germany, though at this time the new rules are not known.

In general it has been held that heating is the only factor that would weaken diastase in honey. Information in the Dutch and German scientific literature indicated that some honeys lose some diastase in storage, but no definitive work was reported. In this country, Schade, Marsh and Eckert [2/] at Davis, California, recently developed a new method for diastase determination that appears to have won favor in Germany. We have used it for our studies on the composition of American honeys.

As was described in the preceding article in this series, some of the honey samples which we received from producers for this project were divided. Part was stored at -4°F. which minimized chemical and enzymic changes. After a suitable interval, these samples and their corresponding samples stored at room temperature (73°-82°F.) were analyzed for diastase activity.

Diastase Decreases in Storage Without Heating

None of these samples had ever been heated. Twenty pairs of samples stored at the two temperatures were analyzed. The time of such storage varied from 4 to 21 months. All sub-samples stored at room temperature showed much lower diasase values than the corresponding part of the sample stored at -4°F. They did not all show the same rate of loss. The average diastase value of the cold storage samples was 22.0, while that of the portions stored at room temperature for an average of 13 months was 13.4. This is a 38.9% loss of diastase, corresponding nearly to 3% per month. Many of the samples with acceptable (to European importers) diastase values had values after storage of one to one and one-half years that would not be acceptable. Only samples with exceptionally high values at the start had values that would be considered good at the end of the storage period. Furthermore, it was found that the rate of loss for high diastase samples was significantly greater than was the rate for moderate or low-diastase honeys.

Another way to express our results is that in ordinary storage at room temperature without heating, diastase in honey has a half-life of 17 months. This means that in 17 months a sample will lose half of its diastase. In 17 more months, half of the remaining diastase would be lost, and so on.

Further Work Planned

We are planning to look further into the stability of diastase and other enzymes in honey during different temperatures of storage. It is not uncommon in processing and storage for honey to be exposed to temperatures much greater than those used here. Temperatures averaging 85° or 90°F. for a few weeks or months might have several times the effect of 70°-75° temperatures. None of this enters the realm of the effect of heat processing of honey, which has been the aspect of this problem previously studied.

There is one additional bit of information in the literature on the effect of ordinary storage of honey on its dias-

2/ Schade, J., Marsh, G. E., and Eckert, J. E. Food Research 23, 446 (1958).

tase content. In the work of Schade, Marsh and Eckert referred to above [2/], they published data on seven honey samples stored at 20°C. (68°F.) for 13 to 15 months. They stated that the diastase activity had "decreased slightly but not significantly in most cases". Using their data, we analyzed them statistically and found that the changes were highly significant [3/]. Their data showed an average decrease for the seven samples on which they gave data of 10.1% in diastase number, or 0.72% per month. This rate of loss is real, but does not present a serious practical problem.

3/ Exceeding the critical value at the 1% probability level.

Factors Affecting Diastase Loss Rate

We attempted to find if any significant relationship existed between the rate of loss of diastase in our storage experiments and the composition of the honey samples. Among the 20 samples the average rate was 2.95% per month, but the lowest rate was 1.41% and the highest 4.76%. No significant relation was found with moisture, total acidity, hydrogen ion concentration (an expression of active acidity or pH) or ash content. Rate of loss was found to be significantly [3/] higher in the samples stored shorter times (4-8 months).

(Next month: - Summary and conclusion.)