

2. SERVICE AND UNITS

ARS - EU - PPL

3. LINE PROJECT TITLE

Identification of the pigments of beeswax, as an aid to refining of domestic beeswax.

4. WORK PROJECT TITLE

Sugar and Sirups Investigations

5. PROJECT LEADER AND ADDRESS

J. W. White, Jr., EURDD, Philadelphia 18, Pennsylvania

6. LOCATION OF WORK

Wyndmoor, Pennsylvania

7. ESTIMATED DURATION

3 years

8. OBJECTIVE; 9. JUSTIFICATION; 10. PLAN OF WORK; 11. COOPERATION

8. Objective

To identify the coloring matters of beeswax as an aid to refining of domestic beeswax.

9. Justification

Thoses phases of agriculture which depend upon insect pollination are becoming increasingly dependent on honeybees, since increased use of herbicides and insecticides and elimination of fence rows have largely reduced the natural population of wild pollinating insects. In the face of this greater need, the number of bee colonies has actually declined by 11% since 1946. This is partly due to severe losses by insecticides, but mostly to inadequate financial incentive for beekeeping. Although the 600,000 U. S. beekeepers produce 210-270 million pounds annually, the gross value of the honey and wax produced is only \$40,000,000. These beekeepers are scattered over the 48 states and most are small operators. Thus their direct support of research and marketing operations is most limited.

Beeswax is an important apiary product. Its unique properties generate an industrial demand for about twice the amount produced in this country. Average United States production (1952-1957) was 4,343,000 pounds, with a value of \$2,110,000. Over this period imports averaged 4,743,000 pounds. Imported wax is preferred for many uses; it consistently commands a premium of 7 to 11 cents per pound over domestic wax. At least part of the lower value placed on domestic wax is due to its variable quality and frequently dark color. Imported wax is generally easily bleached, while domestic wax is not. Other properties also contribute to the lower quality of much of the domestic wax.

This project will be concerned with the identity of the coloring matter of domestic beeswax of various grades. It is hoped to isolate and identify the pigments and provide a sound fundamental basis for possible improvement in refining procedures. The necessity of identifying pigments

BINDING MARGIN

12. SIGNATURES

TITLE

DATE

RECOMMENDED

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July 24, 1958

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APPROVED

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9/25/58

of beeswax as a requisite to processing studies was pointed out in 1940 by Bisson, Vansell and Dye in USDA Technical Bulletin 716. Methods of refining and bleaching beeswax have been in use for years ("Production and Use of Beeswax"-- Graut in "the Hive and the Honeybee", Chapter XX. Dadant and Sons, Hamilton, Illinois). They have largely been developed without a firm fundamental basis. While it is thought that the difficulty in bleaching domestic wax is caused by its higher propolis (plant resin or "varnish") content (Bisson, Vansell and Dye), little is known of the nature of the coloring materials. Carotenoids have been identified in European wax, probably originating from pollen (Tischer, Z. Physiol. Chem. 267, 14(1940) ), and also chrysin, (Jaubert, Compt. Rend. 184, 1134(1927) ), probably from propolis. Carotenoids can be sun-bleached. If the colors of premium imported waxes are of this type, its ready sun-bleaching is explained. Another source of objectionable beeswax color is metal, especially iron, contamination. Identification of the materials responsible would be important. No other known work is in progress in the Department along the lines indicated in the Plan of Work.

10. Plan of Work

Beeswax samples representing the commercially important ranges of color will be collected. The investigation will require the use of solvent extraction and both partition and adsorption chromatography for isolation, separation, and purification of the various pigments present. It is anticipated that several classes of pigments will be encountered, which will ultimately be characterized by the physical and chemical properties of the isolated compounds. Infrared, visible and ultra-violet spectrophotometry, as well as X-ray diffraction will be employed in this part of the study. The exact plan of work to be used will depend on the types of compounds encountered. When the compounds are identified and hence their chemical and physical properties known, it should be possible to develop a rational means of removing or destroying them. About 1.0 man-year annually will be required in this project.

11. Cooperation

It will be necessary to enlist the cooperation of beeswax producers and refiners to ensure that properly representative material is used in the work.