

At Timmons ville, S. C., the work is largely concerned with cannabis, species of capsicum and a few oil bearing plants. In Florida, where the station is at present located at Orange City, we find one of the most interesting parts of our field. Here the opportunity for the selection and improvement of plants yielding essential oils is very promising and the data so far secured with respect to camphor, monarda, rose geranium, lemon grass, citronella grass, and a number of other species clearly show that further important results will be obtained by continuing the present line of investigations. For example, strains of *Monarda punctata* have been developed by selection which give an unusually high yield of an oil containing the valuable constituent thymol. We are now seeking to increase the percentage of thymol in the oil through suitable modifications in the conditions of growth of this plant.

To extend this discussion further would perhaps be a presumption upon privilege but if the remarks just made on the work of the Office of Drug Plant Investigations have suggested something of the scope of the field of Drug Plant Breeding, the purpose of this paper is fulfilled. It may be permitted to say in closing that the breeding of medicinal plants not only offers much in a very practical way but also affords a field for the greatest scientific activity.

THE PAPAIN OF COMMERCE.

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Much has been said and written about papain, yet much more needs to be said and written about it before its adulteration can be stopped, and before it will be possible for it to occupy the place in our materia medica that it should.

Papaw—*carica papaya*—is a tree cultivated in southern Florida, tropical America, and in all tropical countries. It is supposed that the parent trees from which the present cultivated forms were derived originally grew wild in the West Indies. In proof of this, it is definitely known that the papaw tree was not known in India and other tropical countries before the discovery of America. Under favorable conditions a tree grows to a height of twenty feet. The unbranched trunk is light green and smooth, except for the leaf scars. The leaves are light green above, paler beneath, five to seven lobed, the lobes again divided into smaller lobes; the petioles of the leaves are frequently 1.5 dm. long. The leaves occur in greatest numbers at the top of the stem where they stand nearly erect. The older, larger leaves droop and finally fall away as the trunk increases in length. There are three types of flowers borne on as many different trees. The fragrant staminate flowers are in slender panicles, one to three dm. long; the calyx 1.5 mm. long; the corolla is saucer shaped, 3 cm. long; the slender tube is dilated at or near the top. The lanceolate lobes of the corolla are shorter than the tube. The ovary, if present, is rudimentary and no stigma is developed. The pistillate flowers occur singly or in groups of two or three. The calyx is about 5 mm. long and does not fall off after fertilization. The lanceolate petals stand erect to a height of 2.5 cm. The egg-shaped ovary is bluntly five-angled. The perfect flowers are bell-shaped, the lobes standing erect.

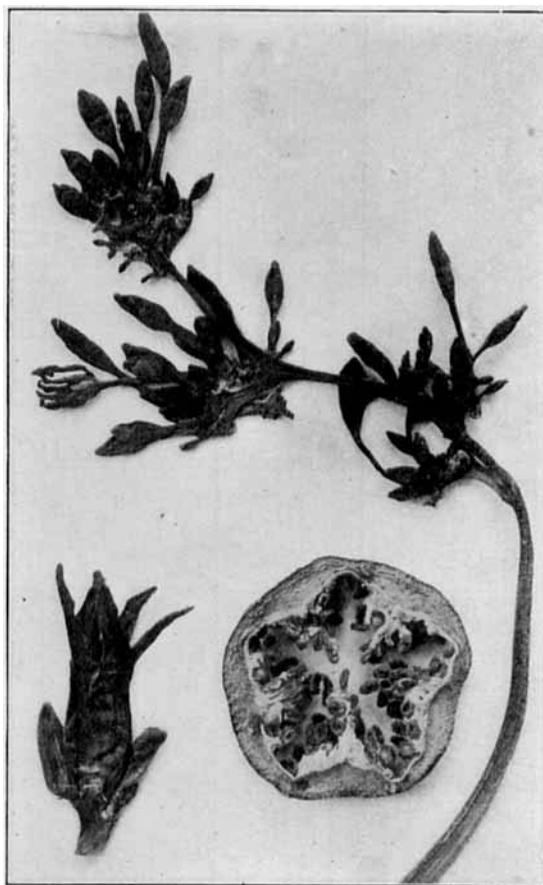
There are five stamens and an oblong ovary. The ripe fruit, which is produced at all seasons of the year, varies in color from yellow to orange. The outer rind is thick and tough while the inner portion is fleshy and edible. Imbedded in the pulp surrounding the central cavity are hundreds of small black pitted seeds possessing similar constituents and a similar taste to black mustard seed. The trees bearing pistillate flowers only, produce rotund fruits having the general appearance of our common field pumpkin; the trees bearing perfect flowers develop oblong fruits resembling the ordinary squash; while the trees developing staminate flowers only, never produce fruits. Often great loss of money and time is incurred when a large percentage of the trees planted in an orchard develop staminate (male) flowers. There is, therefore, a great deal of uncertainty con-



Papaw (*Carica Papaya*).

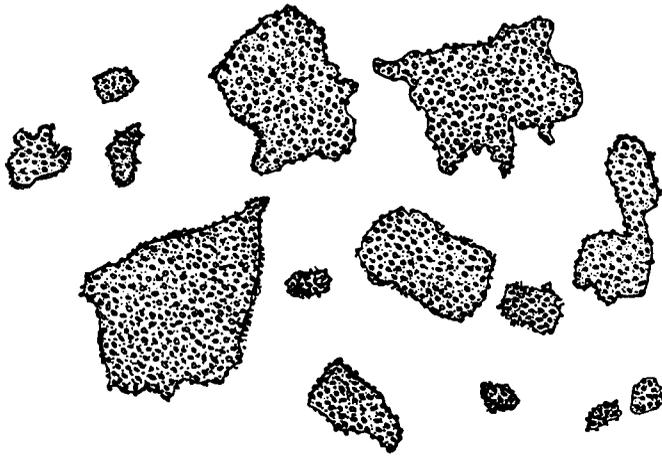
nected with the papain industry at the present time. The papaw trees are planted first for the production of the ripe fruit which is an important article of food and is used by all classes in a variety of ways. During the past winter papaw was obtainable even from the small fruit dealers. They are grown secondly for the purpose of producing papain. The well-developed green fruits are cut or scraped in order to sever the latex tubes, from which flow the milky juice which is collected and prepared for market either by drying or by dissolving the juice in water, filtering, and finally precipitating by alcohol, and drying. Papain of commerce occurs usually in the form of irregular pitted fragments of variable size. The pieces are so brittle that they are readily crushed between the thumb and finger. Papain has an acrid, soapy taste, and if left on the tongue for a few minutes will produce a stinging sensation, and the

part of the tongue in contact with the papain afterwards becomes extremely sensitive to touch. This is doubtless due to the action of the papain on the outer layer of the tongue. The color of papain varies according to the method of production, from nearly white to blackish brown. White papain is nearly odorless, while the brown commercial variety has an odor resembling dried smoked beef. All samples of whole papain become lighter when powdered. Viewed under the microscope papain is structureless, yet all the fragments are

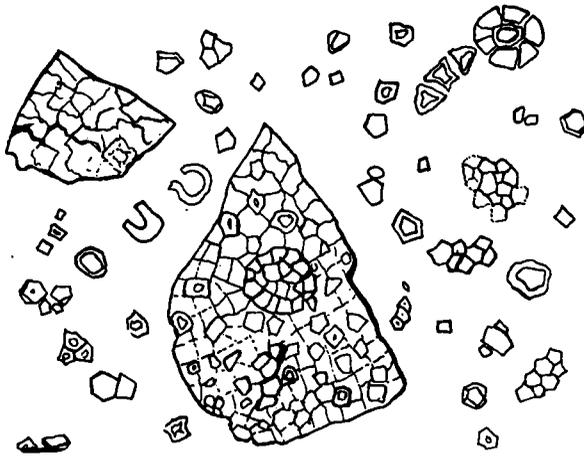


Staminate Flowers, Pistillate Flowers and a Cross Section of the young Fruit of *Carica Papaya*.

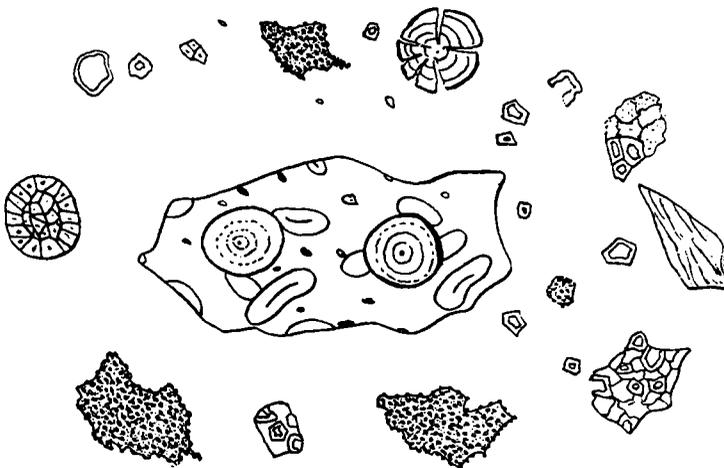
irregular and they appear to be made up of small white and black circles or dots, which give the powder a characteristic microscopic appearance. The quality or digestive efficiency of papain, which is active in the presence of the acid secretions of the stomach or in the presence of the alkaline secretions of the intestines, is usually determined by its action on fresh egg albumen, or on meat fibrin, one part of papain converting about two hundred parts of fresh egg albumen or fibrin into peptones and *albumoses*. Different samples of pure papain vary in digestive activity, this variation is due primarily to the variation of the



Microscopic Appearance of True Papain.



Microscopic Appearance of Rice Bread Papain.

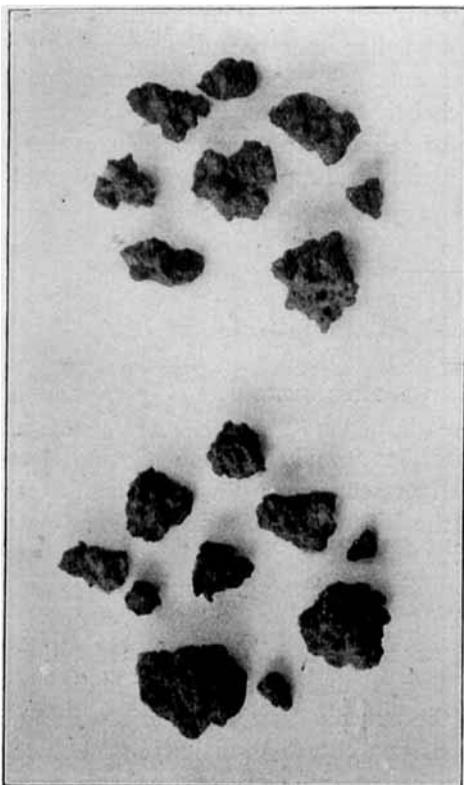


Microscopic Appearance of a Spurious Papain composed of Papain, Rice Bread and Wheat Bread.

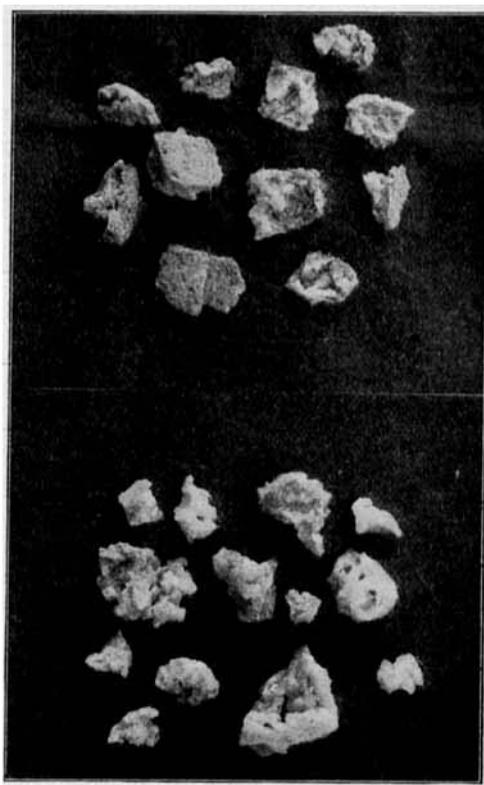
maturity of the fruit at the time when it is incised, the method of collection, the type of tree, and its subsequent purification.

People looking about for ways and means for reducing the high cost of living have overlooked papain. A round steak treated with a solution of papain for an hour or so before cooking becomes as tender and palatable as the best tenderloin.

Papain is too valuable a drug to be discredited and forced into disuse merely because of an insatiable desire for profits. During the past few years it has been a common practice to adulterate papain. This practice has become so preva-



True Papain.



Spurious Papain.

lent that many of the foreign buying samples which are submitted for examination are wholly spurious and are quoted at a higher price than the genuine article. The adulteration of papain was cleverly conceived, and is so cunningly executed that often it requires an expert to distinguish any physical difference between the spurious and the genuine drug. It is supposed that pure papain is whiter than the impure variety. The fact is, its color is no criterion of its strength and purity. Pure papain, if prepared by one process, may be white, while if prepared by another may be brown. This general idea that whiteness means purity may account for the fact that European exporters invariably demand a higher price for the white spurious papain. Many of the spurious samples proved upon

microscopical examination to be composed of unleavened rice bread. A careful search of a number of samples revealed the presence of several pieces of the outer smooth part of the bread, which had been in contact with the baking pan. Other samples contained a mixture of unleavened wheat and rice bread. These spurious samples varied quite as much in color as the pure papain. In some cases the bread had been scorched in order to make it more closely resemble the darker commercial variety, while other samples were grayish-white and resembled the whiter papain of commerce. Still other samples examined showed that the rice bread had been saturated with papain and dried. Selling rice bread for papain yields large profits. Rice bread costs about eight cents per pound. (No yeast or salt is used in its preparation.) This same eight-cent bread when sold as papain brings over two dollars per pound, thus netting a profit to the adulterator of about 2400 per cent. Schemes for extracting gold from sea water, or selling gold bricks are christian acts compared to the getting-rich-quick, and the safe (to date) practice of selling rice-bread for papain.

The surest and the quickest way to put a stop to the present practice of adulterating papain is to make the drug official.

THE TESTING OF LINSEED OIL FOR GLOSS OIL.

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In the examination of linseed oil the writer has found some difficulty in detecting "gloss oil," prepared from rosin, even if present in considerable quantity, by employing the pharmaceutical test, that is the Liebermann-Storh reaction.

Although Lewkowitsch¹ and Spayd² give directions for applying the above test somewhat different than found in the U. S. P. the modified method does not give satisfactory results in case of gloss oil.

Spayd's² modification is as follows: "by taking 2 cc. of the suspected oil and boiling with 10 cc. of acetic anhydride, adding about 10 cc. of water and allowing to thoroughly cool; then drawing off the aqueous portion, filtering through a wet filter and cautiously adding a drop of concentrated sulphuric acid to the clear filtrate. If the rosin or rosin oils to the amount of 0.5 percent. to 1 percent. are present a beautiful fugitive color will be produced.

The objections to the old method, that is the one of slightly warming with glacial acetic acid and adding a drop of strong sulphuric acid to the clear portion, are: First, nine times out of ten, the acid is not clear. Second, in a number of experiments that I made using other oils such as cottonseed, tongue, lard and linseed, I found they gave color reactions hindering the fugitive development to such an extent that one could not definitely say whether resin or resin oils were present or not. By using the modification, I was able to positively detect as low as 2 percent. of resin or resin oils in a mineral oil mixture, and as low as 3 or 4 percent. in linseed oil."

¹Lewkowitsch Oils, Fats and Waxes, page 384.

²Chemical Engineer, Vol. 3, page 224.