Since ascaridole is quite unstable under certain conditions, the oil is very liable to deteriorate on keeping especially if precautions are not taken to keep cool and exclude light.[1] Quite a large proportion of the ascaridole might become thus altered without changing the physical constants so that they would fall without the limits prescribed by the Pharmacopoeia.

The estimation of ascaridole in the oil was accomplished by Schimmel and Company,[2] by fractional distillation, and is stated by them to be from 62 to 65% in normal oil of specific gravity 0.9708, from 45 to 50% in light oil, specific gravity 0.9426, and 65 to 70% in an oil distilled by themselves.

The residue left on vacuum distillation[3] seems to be of some value in indicating to what extent the ascaridole has become altered, but as the results depend on the degree of vacuum employed and the temperature at which the distillation is carried on, they can only be an approximate measure of the non-volatile, resinous or polymerized material.

The method here proposed depends on an observation of Flu, DeLangen and Weehuizen[4] that ascaridole is soluble in a mixture of 60 parts by volume of glacial acetic acid with 40 parts of water.

In order to determine the action of the reagent on the terpenes of the oil, 10 Cc. of chenopodium terpenes were shaken with 60% acetic acid in a cassia flask and found to be insoluble. 10 Cc. of ascaridole, similarly treated, dissolved to the extent of 98% and the residue remaining was a viscous oil which was probably altered or polymerized ascaridole.

Accordingly all that is necessary to rapidly estimate ascaridole in oil of chenopodium is to agitate 10 Cc. thoroughly in a cassia flask, the neck of which holds 10 Cc. graduated in tenths, with 60% acetic acid.

The flask is then filled to the mark with 60% acetic acid and allowed to settle, or carefully centrifuged. The volume of undissolved oil deducted from 10 and multiplied by 10, gives the volume percentage of ascaridole in the sample.

The following are some results obtained by this method:—

Sample No.	$d\frac{25}{25}$.	Rotation.	Solubility.	Per cent ascaridole. By distn.	By acetic acid.
1.....	0.9564	—6.5°	O.K.	64	70
2.....	0.9640	—5.0°	O.K.	..	70
3.....	0.9564	—5.65°	O.K.	..	64
4.....	0.9704	.....	....	..	73
5.....	0.9325	.....	....	..	48

A REPORT ON THE ZAMIA STARCH SITUATION.*

BY JOSEPH F. CLEVENGER.

One region in Florida where the Zamia plant, *Zamia floridana* DC., grows was visited and a number of the plants were dug up and examined. In addition, the only mill manufacturing starch from the plant was visited. The following information was collected:

[1] Nelson, *Cir. Bur. Chem.*, No. 109, Jan. 1913.

[2] Schimmel and Company, "Semi-Ann. Report," April 1908.

[3] Nelson, *Jour. Am. Chem. Soc.*, 42, p. 1204.

[4] Mededeel. u. het. geneesk. lab. te Weltervreden, 3rd ser. A, 1919, pp. 1–28.

* Presented at the sixty-ninth annual meeting of the American Pharmaceutical Association, New Orleans, La., September 6–11, 1921.

Description of Plant.—Zamia is a small dioecious plant, with a crown of leaves producing on different individuals pistillate (Pl. 1, A) and staminate (Pl. 1, B) strobili (cones). This is characteristic of the Cycadaceae to which family the plant belongs. The seeds (Pl. 1, D), which are developed in the pistillate strobili, are somewhat oval, measuring approximately one-half inch in length. The cross-section shows a triangular outline, a relatively thin, hard seed coat, and a starchy endosperm. When the seeds are mature the pistillate strobili disintegrate and the seeds may frequently be observed in large numbers near the base of the crown of leaves. The plant has an enlarged tuberous-like stem (rhizome) which grows below the level of the ground. This habit of the plant enables it to withstand the frequent fires to which the region where it grows is subjected. It is of interest that numerous root tubercles, presumably collecting nitrogen from the atmosphere, as do the nodules of the Leguminoseae, occur on the roots of this plant.[1] (See Pl. 1, C, N.) These tuberous-like stems contain large amounts of starch.

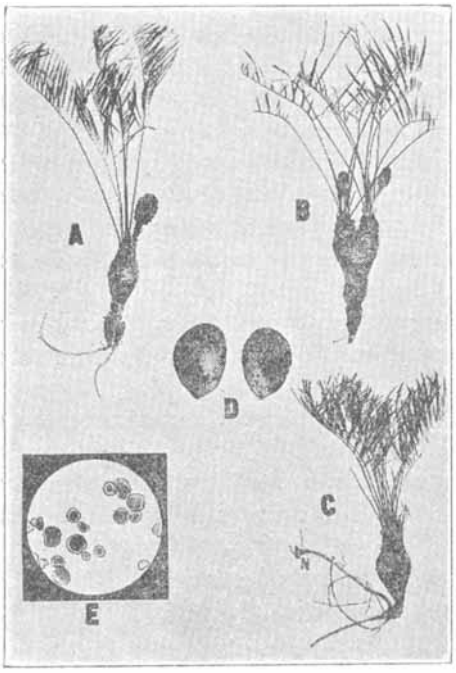

Plate 1. *Zamia floridana DC.*

A. Female plant showing tuberous-like rhizomes, crown of leaves, and a pistillate strobilus (cone). Approximately × 1/5.
B. Plant showing staminate strobili (cones). Approximately × 1/5.
C. Plant showing root tubercles. N. Approximately × 1/5.
D. Seed. Approximately × 1/2.
E. Starch grains. Approximately × 80.

The starch grains (Pl. 1, E) are simple with the exception of a few compound grains of few components. The single grains are spherical ovoid and dome-shaped and vary in size from 6 to 40 microns in the longer axis. The majority of them vary from 16 to 32 microns in the longer axis.

Analysis of Rhizome.—The following analysis of the plant on an air-dried basis, made in the Cattle Food and Grain Investigation Laboratory, Miscellaneous Division, Bureau of Chemistry, may be of interest:

Moisture	7.73%
Ash	5.01%
Ether extract	0.63%
Protein (N × 6.25)	6.17%
Crude fiber	9.23%
Nitrogen-free extraction	71.23%
	100.00%
Starch (diatase method)	37.75%
Ash insoluble in 10% HCl	0.90%

[1] Karl F. Kellerman, "Nitrogen-Gathering Plants." U. S. Department of Agriculture Yearbook, 1910, pp. 213–218.

Of further interest in this connection is the report by Gifford,[1] that water which has been used in washing the starch, when drunk by animals, produces slow poisoning. The character of this poison is not known.

Growing Region of the Plant in Florida.—The region where the plant is collected for manufacturing purposes is restricted to a limited area in the vicinity of Miami, Florida, although it grows in the pine lands throughout the southern part of the State.[2] This area does not extend appreciably south of Miami and not much north of Dania, nor in the regions which are subject to overflow. The total area in which this form grows may be roughly estimated to cover about 150 square miles. The area, however, in which the plant may be profitably collected is rapidly diminishing on account of the rapid growth of the city of Miami and its suburbs. The occurrence of a closely related form farther north in the central part of the state is reported, but it is does not appear to be used as a source of starch.

Cultivation of the Plant.—Zamia has not been cultivated on a commercial scale. Attempts made in California to grow this plant from the seed were apparently unsuccessful, possibly due to the absence in the soil of the organisms forming the tubercles.

Supply of Rhizomes.—The manufacturer depends for his supply chiefly upon collections by the local residents, who are employed to dig up these rhizomes. It is stated that the same region may be profitably worked over once each five years.

Preparation of the Starch.—The method used in preparing this starch is similar to that used for other starches. The undried rhizome, when ground and mixed with water, is passed over a fine screen to separate the main portion of the vegetable tissues from the starch. The product is then run into settling tanks, where a further separation is obtained. After the starch has settled it is drawn off and dried. The whole operation requires approximately three days.

Use of the Starch.—The starch (Pl. 1, E) is used by natives as a food and in limited amounts in making crackers, biscuits, and other food products requiring starch.

Present Status of the Industry.—While the mill under normal conditions is reported to have a capacity of about 24,000 pounds per week, or about 750,000 pounds per year, it has been idle since September 1920.[3] It is uncertain when this mill will be in operation again. The manager contemplates, when circumstances permit, to manufacture starch from Zamia rhizomes and also to ship Maranta roots from the West Indies with the idea of preparing starch from them.

Analytical data, such as the tincture power of different reagents, optical properties, and temperature of gelatinization, determined by Reichert[4] for both Maranta and Zamia starch, have been partly checked by the writer. Although useful as a means for differentiation, these data have little or no value as a means to determine the relative value of the starches. The author has been unable to find any definite information regarding the value of Zamia starch as compared

[1] John Gifford, "The Everglades and Southern Florida," 2nd Ed., 1912, p. 173.

[2] Winifred Kimball, "Reminiscences of Alvan Wentworth Chapman," *J. New York Botanical Garden*, 22, 13, 1921.

[3] Mill visited on January 15, 1921.

[4] E. T. Reichert, "Differentiation and Specificity of Starches in Relation to Genera, etc.," 1913.

with other starches. It is claimed by the manufacturer, as indicated on the label of the carton of his package product, that "you do not get that starchy taste by using Florida Arrowroot."

Designation of the Product.—Zamia starch has been marketed under the designation "Florida Arrowroot." True arrowroot starch is obtained from Maranta root. This double use of the term arrowroot has led to confusion in the trade which will become greater if Maranta starch is manufactured in Florida, as now seems possible. It is of interest that *Maranta arundinacea*, the plant yielding the product generally referred to as arrowroot starch, is cultivated to a limited extent in some localities in southern Florida.

The names "Koonti," "Coontie," or "Comptie," used by the Seminoles, refer not only to the Zamia plant and its products, but have the general significance of the word "bread," "grits," or "grub."[1] Since differences in the spelling as well as in the pronunciation of these terms also occur, it is evident that none of them would be a well-chosen name. The names "Florida arrowroot starch" or "Florida arrowroot flour" should not be used for the reasons already given. The designation "flour" is distinctly objectionable, since during the process of manufacture tissue elements are practically eliminated.

In conclusion, the specific name Zamia starch should be applied only to the product obtained from Zamia plants.

NOTE: After completion of the manuscript, an article by J. K. Small appeared in the *Journal of the New York Botanical Garden*, Vol. 22, pages 121 to 137, 1921. It is entitled "Seminole Bread—The Conti; a History of the Genus Zamia in Florida." The reader will find here interesting additional information on the subject of Zamia and its products.

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THE ESTIMATION OF NITROGLYCERIN IN TABLETS OF NITROGLYCERIN AND SPIRIT OF NITROGLYCERIN.*

BY R. I. GRANTHAM.

Several methods have been proposed for the estimation of nitroglycerin but, up to the present time, none of these have proved to be quite satisfactory. The method to be proposed here is essentially the Devarda method for the estimation of nitrogen in inorganic nitrates. However, the details of the method have been so modified that its practicable application to nitroglycerin has been made possible in the average laboratory. The results obtainable are quite satisfactory.

Of the various methods which have been proposed for the estimation of nitroglycerin the following may be mentioned:

I. Saponification Method.—This method depends upon the saponification of

[1] Clay MacCauley, "Seminole Indians of Florida," Fifth Annual Report Bureau of Ethnology, 1883–4, p. 513.
Gifford, *Loc. cit.*, p. 170.

* Read before Scientific Section A. PH. A., New Orleans meeting, 1921.