NOTES ON THE DASHEEN AND CHAYOTE

HEBER W. YOUNGKEN

Within comparatively recent years, the United States Department of Agriculture has introduced into southern horticulture two exotic vegetables, the Trinidad dasheen and the chayote. The success attending their experimental culture, and the steadily increasing demand by the populace of many sections, have encouraged their commercial cultivation to a limited

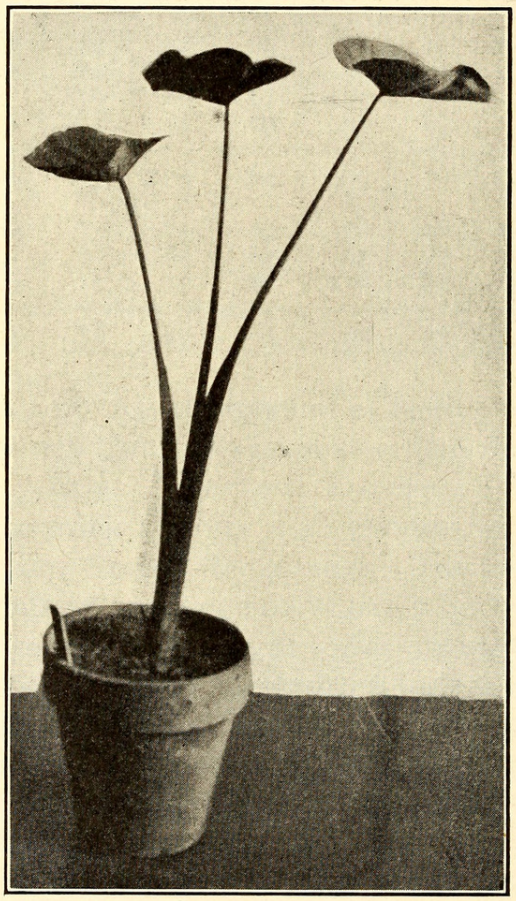

FIG. 1. Three-months-old plant of the Trinidad dasheen, *Colocasia esculenta* (L.) Schott, as grown in the greenhouse of the Philadelphia College of Pharmacy.

degree. It may be safe to predict, however, that when the delicacy of their flavor becomes more generally known, they will be cultivated to such an extent as to be common articles in our markets alongside the potato and the squash.

The Trinidad Dasheen

The Trinidad dasheen was introduced into the United States from the Island of Trinidad, West Indies. Its native home was probably China, partly because certain varieties of the taro closely allied to it have been found growing in that country and partly because its name appears to be a corruption of the French phrase "*de la Chine.*"[1]

The plant is a variety of *Colocasia esculenta* (L.) Schott, a member of the Araceae, and closely related to the common elephant's ear plant of our gardens. Its underground parts (fig. 3) consist of a large central corm

Fig. 2. Mature plant of the Trinidad dasheen, as grown under field culture in Florida.

weighing from two to four pounds, of spheroidal or broadly fusiform shape and reddish brown color, and, in addition, numerous lateral cormels, which spring from various nodes along the periphery of the mother or central corm. Both mother corm and lateral cormels are marked by the presence of numerous rings which represent leaf scars. When the lateral cormels are removed, large circular to ovate, light-colored spots are exhibited. The total from one hill of these underground portions ranges from 4 to 30 pounds. The aboveground parts (figs. 1, 2), consist of several petiolate, auriculate, peltate, bright green leaves, three feet or more long, and a spadix, which is free and terminated by a sterile appendage.

[1] Young, R. A. The dasheen; its uses and culture. Sep. 689, Yearbook U. S. Dept. Agr., 1916.

Histology

When examined microscopically, sections of the Trinidad dasheen corm, passing from the periphery toward the center, show the following histological peculiarities:

1. A zone of cork composed of numerous layers of cells with suberized walls, varying in size from irregular polygonal to rectangular.

2. A broad zone of phellogen, composed of more or less rectangular, tangentially elongated cells with rich protoplasmic contents.

3. A broad central matrix composed of parenchyma, the cells of which are mostly thin-walled and abundantly filled with starch. The starch grains are mostly simple, but compound grains composed of as many as eight units are occasionally met with. The

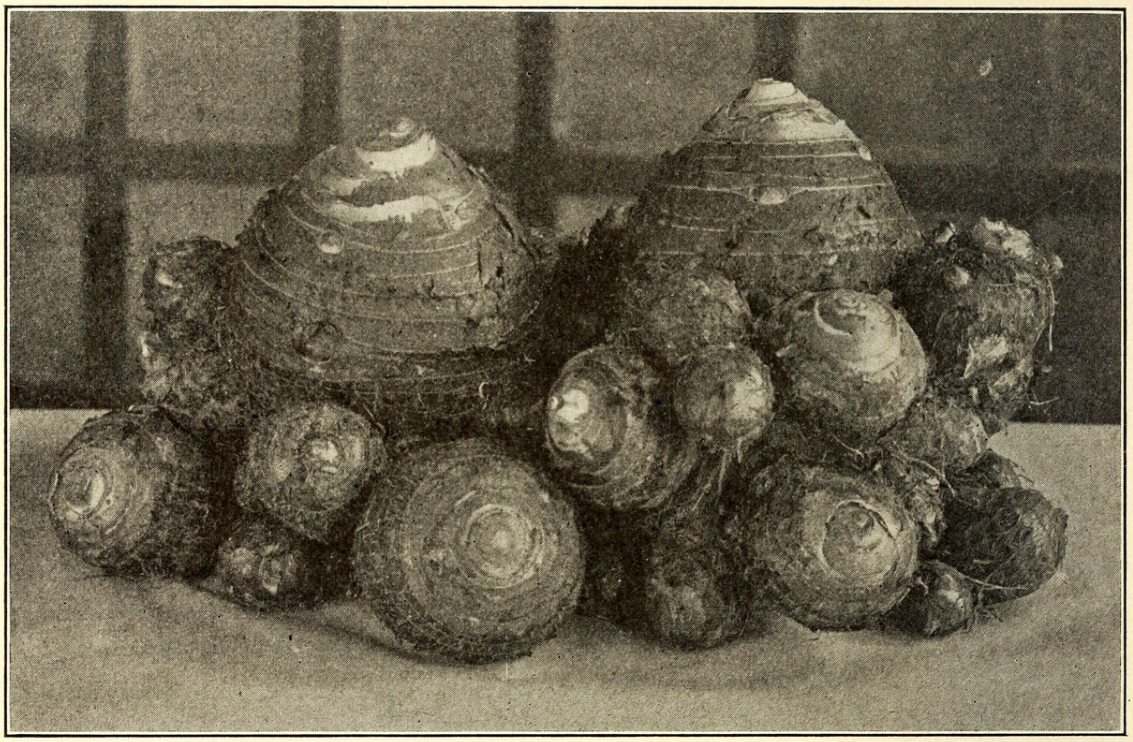

FIG. 3. Two mother corms with their lateral cormels, the product of an eleven-pound hill of Trinidad dasheens (photo. by R. A. Young).

simple grains vary in outline from rounded to irregularly rounded to irregularly ovate or angular. Some of these are devoid of striations or distinct hilum, while others show both of these structures. In size, they range from 3 μ to 19.2 μ. The hilum, when distinct, varies from linear to circular to angular to several-cleft. The lamellae and striations, when distinct, are always concentric. These, as well as the hilum, may be well observed in a mount stained with dilute gentian violet. Scattered throughout this region are to be noted numerous mucilage reservoirs of irregularly rounded, oval or ellipsoidal outline, whose contents are deeply stained with basic aniline dyes. The fibrovascular bundles are of concentric type and may be found scattered throughout the section in irregular fashion. From the main axis bundles, numerous branch bundles emanate at various levels, which course out into the lateral cormels. Crystals of calcium oxalate are found in numerous cells of the central matrix in the form of raphides.

Uses of the Dasheen

The portions of the plant suitable for diet are the corms with their lateral cormels and the aerial shoots. The former are not intended to replace the white or the sweet potato, nor the latter the asparagus, but rather to augment the comparatively small number of starchy vegetables now in use in our country. The underground parts, which are sold as "dasheens" in some of our markets, contain about 50 percent more protein and 50 percent more starch and sugars than the potato tuber. The average of ten analyses of these portions made by the Department of Agriculture is as follows:

	Percent
Solids	37.235
Ash	1.3
Starch	26.097
Soluble sugar	1.75
Ether extract	.157
Crude fiber	.71
Proteids	3.03
Pentosans	1.24

The corms and cormels are employed in the same manner and in quite as many ways as the white potato. When baked or boiled, the interior of a mature specimen is mealy, though firmer than the potato, because of its comparatively lower water content. Its flesh varies in color from cream to more frequently grayish-white or tinged with violet. Dasheens are best eaten directly after they have been baked or boiled. If kept standing, they gradually lose in palatability.

An excellent flour has been made from dasheens. The corms and larger cormels are pared and either sliced or shredded and then dried and ground in a mill. This flour is mixed with that of wheat or rye in the proportion of one part of the former to three or four parts of the latter.

The shoots are said to be more tender than those of asparagus. These are blanched, before being used, by forcing them from larger corms in the dark.

The Chayote

This vegetable, concerning which little has been recorded, is the fruit *Chayota edulis* Jacq., a native of tropical America. The plant (fig. 4) is a climbing, sparsely hairy vine, with perennial tuberous roots. Its stem bears alternate, cordate, palmately three-lobed or -angled leaves, which are membranous in texture. From points along the stem opposite the leaves 2–5-branched tendrils arise, which assist the vine in climbing. The flowers are monoecious and axillary; the pistillate are solitary, while the staminate are borne in small clusters. The calyx tube is crateriform with a five-lobed limb. The greenish to cream-colored corolla is rotate, deeply five-parted, the segments being ovate-lanceolate. The filaments and styles

are connate into a central column of which 2-celled anthers appear as lobes. The stigmas are closely set together, forming a small head. The ovary is inferior. The fruit is a greenish or ivory-white, fleshy, pear-shaped, or globose, one-seeded pepo. Its surface is more or less corrugated and marked

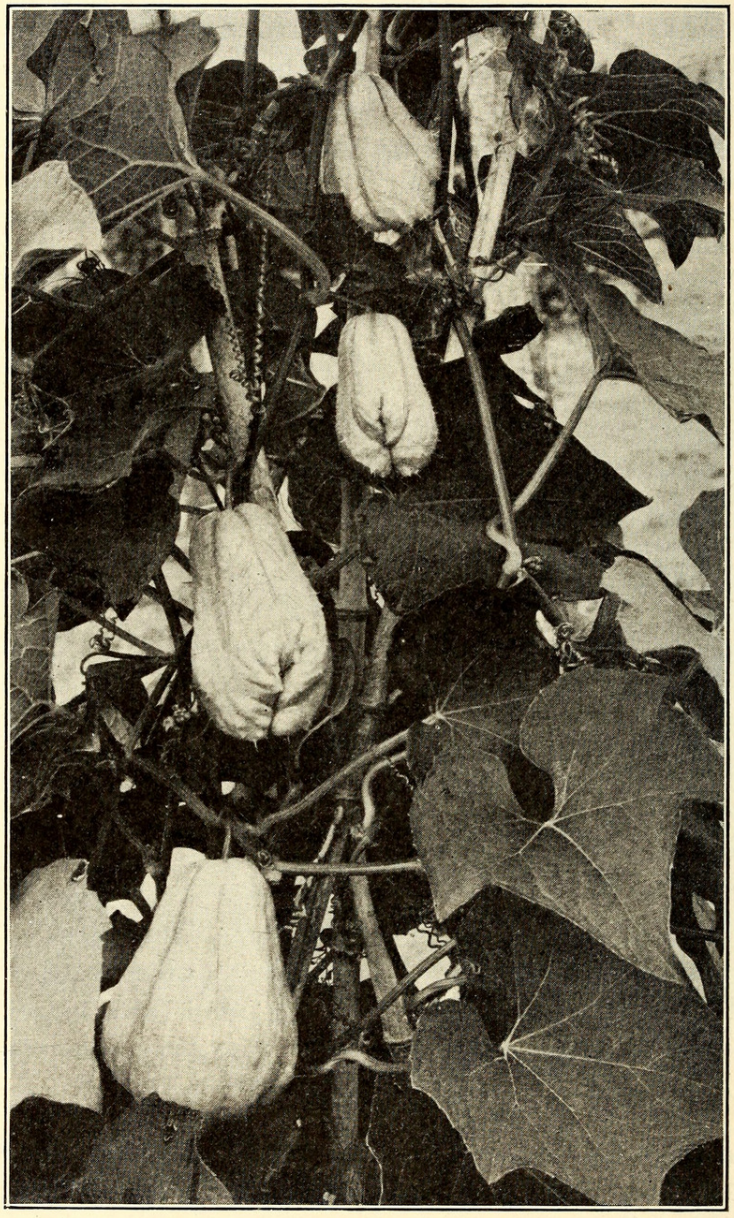

FIG. 4. Plant of the chayote, *Chayota edulis* Jacq., as grown under field culture in the South by the Bureau of Plant Industry, U. S. Department of Agriculture.

by the presence of spines around both ends. The embryo protrudes from the center of the distal end (fig. 5) before the fruit is mature. The seed is exalbuminous and consists of a seed coat firmly adherent to the endocarp and enclosing two cotyledons, a plumule, and a radicle. The cotyledons attain a length of from 2 to 2½ inches, which is on the average one-half the length of the fruit. The average weight of the fruit is about eight ounces.

According to a circular issued by the United States Department of Agriculture, the chayote may be grown successfully on any well drained, cultivated lands in those sections of the southern states where the ground does not freeze—anywhere south of a line drawn from Charleston, South Carolina, to Baton Rouge, Louisiana; and along the Gulf coast of Texas. It has fruited at some points north of this.[2] It is reported to have been grown in California.

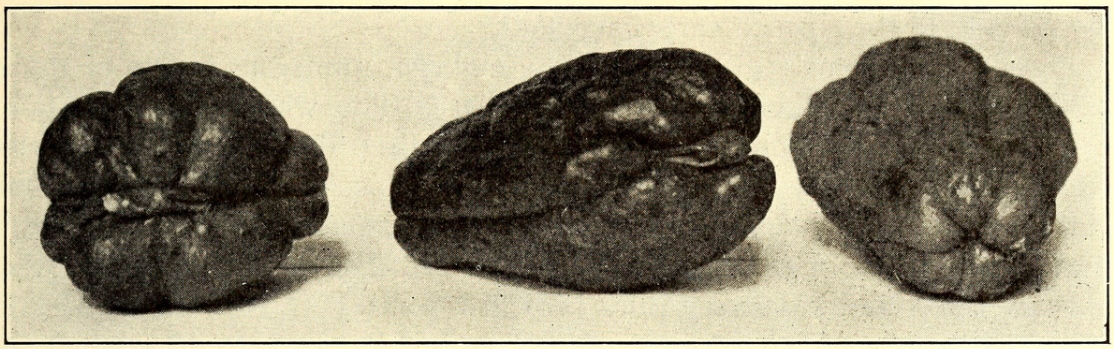

FIG. 5. Fruits of the chayote, one-third natural size. Note, from left to right: distal, lateral, and proximal aspects. The embryo is seen protruding from the distal ends of two of the fruits.

Histology of the Fruit

Alike with other cucurbitaceous fruits, that of the chayote agrees in the fusion of the receptacle with the carpellary portions during the developmental process.

The receptacle constitutes by far the greater portion of the fruit area. In surface section, the outer epidermal cells are polygonal in outline and richly protoplasmic. Many contain small prisms of calcium oxalate. Scattered all over this region and interspersed among the regular epidermal cells may be noted small groups of cells, not unlike the other cells in shape, but having thicker walls and yellowish to light brown fixed oil contents. Stomata may also be found in moderate numbers in this region. These with their guard cells are broadly elliptical in outline. Each is surrounded by five neighboring cells. In cross section the outer walls of the epidermal cells are slightly convex and cutinized. Beneath the outer epidermis is a zone of several layers of parenchymatous cells, many of which have lignified walls. In some instances, lignification occurs in the walls of the cells directly underneath the epidermis; in others the lignified elements are separated from the epidermis by one to several layers of cells with non-lignified walls.

The next broadest zone of the receptacle is composed of more or less radially elongated, thin-walled parenchyma cells, comparatively small in the outer region but gradually becoming larger toward the center. Numerous branched latex tubes with yellowish contents course irregularly through

[2] Circular on chayote. U. S. Dept. of Agric.

this region. Fibrovascular bundles of the bicollateral type are also to be noted. The most conspicuous elements of these regions are the spiral ducts which attain a breadth of 28.6 microns.

Separating the receptacle from the carpellary portion of the fruit may be noticed a sharply delimited band of cells, three layers thick. Of these the outer layer and inner layer are comparatively clear; the middle layer is filled with dense protoplasmic contents. The innermost layer of cells of this region is the broadest, contains starch grains, and doubtless represents the epicarp of the ripened carpellary wall.

Passing from this region toward the embryo, numerous layers of thin-walled cells are noted, of rounded or irregular outline, whose lumina contain either protein or carbohydrate contents or both. This region constitutes the mesocarp. It is traversed by numerous bicollateral bundles. The endocarp consists of a layer of rather small tangentially elongated cells. Over that portion of this region which is unattached to the seed coat, the cells are larger and have very thick brownish walls.

Seed

The seed coat is composed of tangentially elongated cells, the outer walls of which are united firmly to a portion of the endocarp.

Cotyledons

The outer covering tissue or epidermis consists of a layer of cells which in surface view are polygonal, and rectangular when observed in transverse section. Many of the cells of this tissue possess starch grains. Branched stellate hairs and glandular hairs are scattered over this tissue.

Beneath the epidermis is a spongy parenchyma composed of somewhat spheroidal to polygonal cells containing starch grains, which are mostly simple, spheroidal or plano-convex, rarely 2–3-compound. These have an ordinary range of 3 to 28 microns in diameter. Occasionally, somewhat elongated ovoid grains are seen which attain a length of 40 microns.

Radicle

This shows the usual structures typical of this portion of the cucurbitaceous embryo. The cells of the cortex are rich in protoplasm, have prominent nuclei, but are entirely devoid of starch.

Uses of the Chayote

The fruits should be picked from vines when but two thirds or three fourths grown. They lose their delicate flavor and become tough if allowed to mature. They are then employed similarly to the squash. The vines, tuberous roots, and fruits may be used as fodder for stock. The woody stems furnish a fine fiber known to the French as "*paille de chouchon.*"

Botanical Research Laboratory,
Philadelphia College of Pharmacy