

The limited results as shown in Table II are in agreement with the U. S. P. XI statement that the present U. S. P. and International Digitalis Standards are identical in potency. This would indicate that the International Standard, at the time of its adoption, was set at a much higher level than previously accepted clinical standards.

SUMMARY

The U. S. P. XI Digitalis Standard has been compared to the U. S. P. X Digitalis Standard in a series of parallel runs extending over a period of two years.

The results show that the U. S. P. XI Digitalis Standard averages about 50 to 60 per cent stronger than the U. S. P. X Digitalis Standard.

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A Recent Substitute for Jalap*

By Heber W. Youngken

A little more than a year ago the writer received a sample of a root from a pharmaceutical manufacturer who claimed to have purchased it as "Jalap," but which after having been made into a preparation yielded a product so unlike that which the manufacturer was accustomed to recognizing as the Jalap preparation that his suspicions were aroused. Never before had Jalap

been found to yield so low a percentage of resin.

The sample forwarded for identification consisted of transverse segments of a root, the cut surfaces of which possessed a dirty white to pale brown color and exhibited concentric rings of bundles. The segments were lighter in weight than Jalap cut similarly. A cursory examination with a hand lens failed to disclose any evident resin cells.

Cross and longitudinal sections were prepared from it and examined in water, chloral and in phloroglucin-HCl mounts. These showed it to possess a starch- and crystal-bearing parenchyma imbedded in which were a concentric series of open collateral bundles. Typical resin cells, closely arranged, tracheæ with bordered pores, rosette aggregates of calcium oxalate and characteristic starch grains such as Jalap possesses were absent. It differed from Poke, Beet, Amaranthus, Levant and Mexican Scammony, Turpeth Root, Piptostegia and other roots exhibiting concentric circles of bundles with which the writer was familiar. The only tangible clues from a microscopic examination of its structure were the presence of numerous raphides of calcium oxalate, many of which occurred in bundles within crystal cells of the parenchyma, and its possession of a concentric series of secondary collateral bundles.

A search of the literature of pharmacognosy failed to reveal anything recorded which corresponded with this sample.

A possible clue remained. If this material was marketed as "Jalap," it may have been shipped from Jalap-producing Mexico. In thinking of some of the plants commonly found growing there, *Mirabilis Jalapa* flashed to mind. Upon looking up the literature on the anatomy of the axis of this plant, I came upon a brief reference in Solereder's Systematic Anatomy of the Dicotyledons (1). Raphides of calcium oxalate and the concentric series of bundles were there mentioned as occurring in *Mirabilis* species. I obtained some roots of *M. Jalapa* from the Medicinal Plant Garden of the University of Minnesota through the kindness of Professor Fischer. Upon sectioning one of these and comparing its histology with that of the

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unknown sample, the identity was revealed. It proved to be the root of *Mirabilis Jalapa* (Fam. *Nyctaginaceæ*).

The characteristics of this root and of the plant yielding it will now be described.

ROOT OF MIRABILIS JALAPA

Physical Characteristics.—In their entire condition, the roots occur either singly or in clusters of two or more. Single roots, tuberous, conical, a number of them resembling roots of *Aconites* in form, up to 20.3 cm. in length and up to 5 cm. in width at the crown, the crown somewhat rounded and bearing one or more stem bases, the lower portion tapering into a conical tap root. Clustered roots show branching in upper part of primary root, forming in the lot examined from 2 to 3 secondary roots which remain attached to the parent tuberous root and are themselves tuberous. The external surface of these roots is dark brown to blackish brown, transversely and longitudinally wrinkled and showing few to numerous lenticels. The fracture is hard, complete and horny, the fractured surface exhibiting a prominent dark brown cork and a broad whitish cortical and wood region, the latter marked by concentric rings of vascular tissue.

Histology (see Fig. 2).—Transverse sections exhibit a cork region of up to about 20 layers of brick-shaped cork cells having suberized walls and brownish contents, a phellogen of meristematic cells, a cortex of up to many layers of parenchyma, most of the cells of which contain starch, a large number of raphides of calcium oxalate appearing silky in unstained mounts and a scattering of cells with resinous contents. In older portions of these roots secondary phellogens were found at varying levels in the cortex which had layed down cork on their outer faces, forming borke. Beneath the cortex occurs a broad zone of pericyclic parenchyma in which a concentric series of secondary cambia have layed down vascular tissue forming a number of interrupted circles of secondary open collateral bundles. The conjunctive tissue (pericyclic parenchyma) is composed of cells and intercellular air-spaces, the cells having simple pits and containing either starch, resinous material or raphides of calcium oxalate.

The phloem portion of the bundles consists of sieve tubes, companion cells and phloem parenchyma. The xylem portion consists of radially placed xylem strands composed of xylem cells, and groups of reticulate tracheæ, the latter often radially arranged. Isolated reticulate tracheæ were also frequent in the xylem strands. The largest trachea observed measured 157μ in diameter.

Radial longitudinal sections showed the tracheæ to be largely of the reticulate type. In these sections, a large number of raphide sacs of oblong-elliptic outline were to be noted. The raphide bundles were up to 187μ in length. While a few simple pitted tracheæ occur, they were not seen in

the majority of the sections. The cork cells in tangential sections were polygonal in outline. No lignified fibers or stone cells were observed.

Powdered Mirabilis Jalapa Root (see Fig. 3).—Gray to grayish brown. The predominating histological elements were numerous raphides of calcium oxalate, isolated and in bundles, the individual crystals being up to about 160μ in length, starch grains and starch- and crystal-bearing parenchyma. The starch grains were found to be of three types, *viz.*, simple, 2- to 8-compound and oval to spheroidal aggregates. The individual grains varied from

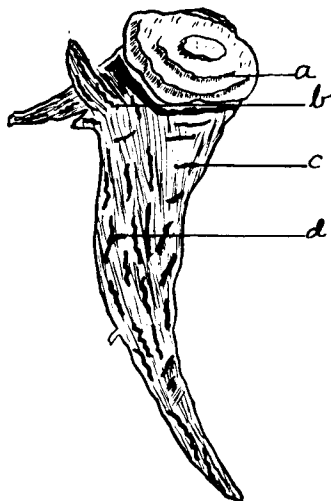


Fig. 1.—Root of the *Mirabilis Jalapa* Linné. *a*, one of several concentric rings of bundles; *b*, lateral secondary root; *c*, lenticel; *d*, longitudinal ridge.

polygonal to plano-convex to angular-convex and were mostly up to 12μ in diameter. Each possessed a central clef hilum. Other elements observed were brownish fragments of cork, the cells being polygonal to rectangular in outline and with suberized walls; occasional small, brown, amorphous masses of resin, fragments of reticulate tracheæ and nonlignified fibers. The odor was peculiar and unlike anything else with which the writer is familiar. The taste was slightly acrid, followed by a tingling sensation and warmth and stimulating the flow of saliva. When moistened and applied to the skin the powder produced a burning sensation. Within ten minutes after smelling and tasting the powdered material the writer experienced a burning sensation in the nostrils, mouth and fauces. This substitute in powdered form is an irritant to the mucosa and skin.

Description of Plant.—*Mirabilis Jalapa* Linné, commonly known as Four o'clock or Marvel of Peru, is a perennial herb of bushy form, native to Peru and other parts of Tropical America. It occurs

in Mexico and is commonly cultivated as an ornamental plant in this country. It was named and described briefly by Linnaeus (2) who unfortunately called its specific epithet, "*Jalapa*" because its tuberous roots were once supposed to be the source of the drug Jalap (3). The plant attains a height of 2 to 3 ft., its stems bearing opposite, ovate, to ovate-lanceolate, short-petioled leaves and long, narrow-tubed, funnel-shaped flowers which vary from purple, to variegated purple, red, yellow to

white. The showy colored part of the flower represents the calyx. The flowers open in cloudy weather or late in the afternoon, whence the vernacular name of "Four o'clock." The species differs from others in the genus *Mirabilis* by producing only one flower in each involucre.

Assay.—The powdered drug was assayed according to the method for the assay of *Ipomœa* in the National Formulary (4) and found to yield 2.78% of total resins.

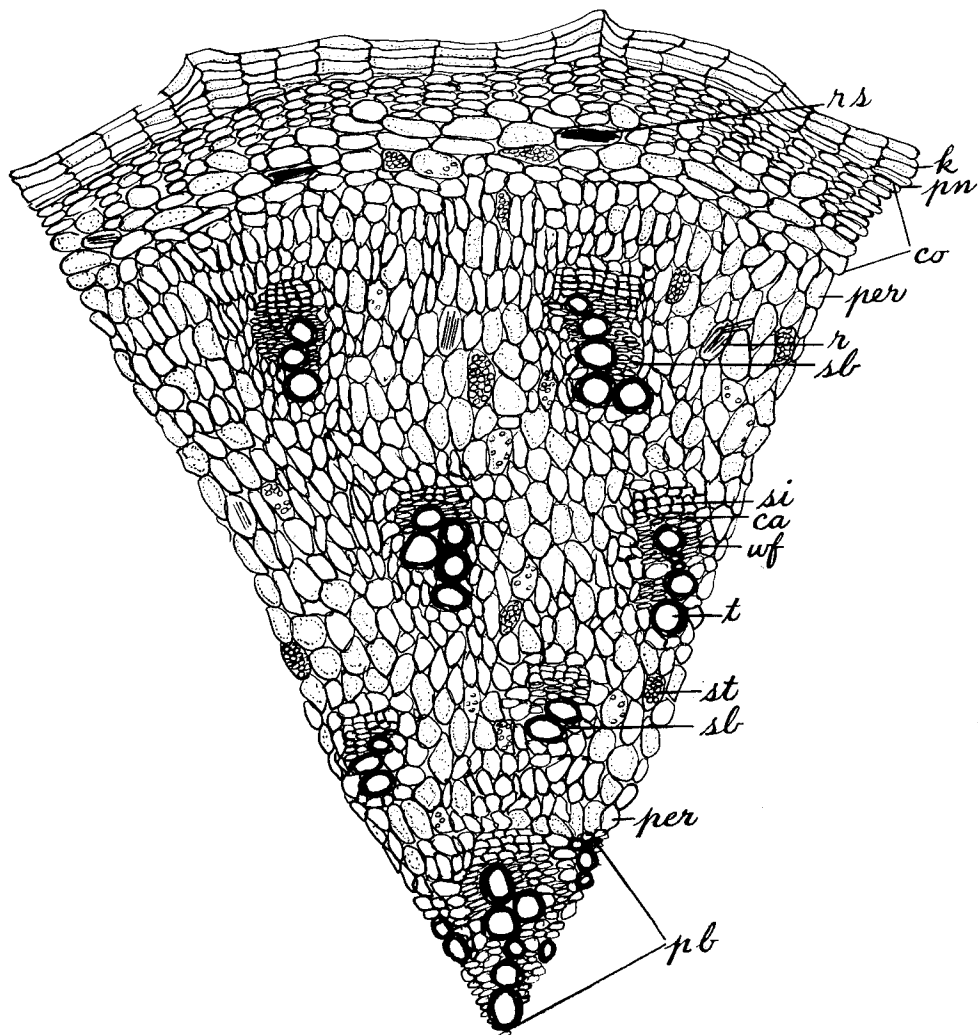


Fig. 2.—*Mirabilis Jalapa*. Representative portion of a transverse section through a young portion of the root. *k*, cork; *pn*, phellogen; *co*, cortex; *per*, pericycle in the parenchyma of which secondary cambia have formed three interrupted circles of open collateral fibro-vascular bundles; *pb*, primary open collateral bundles in the center of the section; *rs*, raphide sac containing a dense bundle of acicular crystals of calcium oxalate; *sb*, secondary fibro-vascular bundles; *st*, starch; *r*, raphides of calcium oxalate; *si*, sieve tissue; *ca*, cambium; *wf*, wood fibers; *t*, trachea.

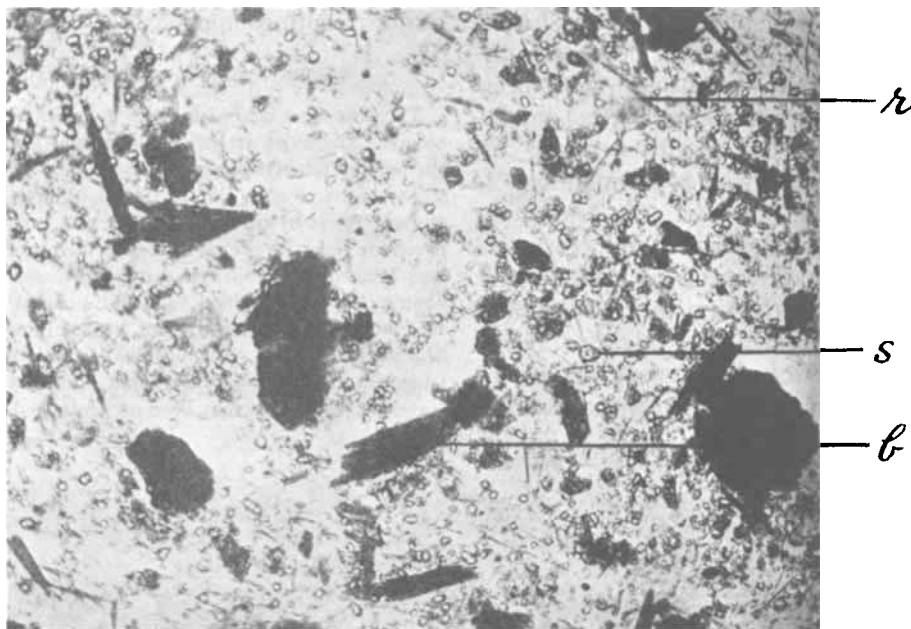


Fig. 3.—Powdered *Mirabilis Jalapa* Root. Photomicrograph X 100. *r*, raphides of calcium oxalate; *s*, starch; *b*, bundle of acicular crystals of calcium oxalate.

SUMMARY

1. A fraudulent substitute for Jalap has appeared on the American market which is identified as the tuberous root of *Mirabilis Jalapa* L.

2. The physical characteristics, histology, and the powdered root of *Mirabilis Jalapa* are described.

3. It is found that the non-lignified character of the cork, the presence of numerous raphides of calcium oxalate, the relatively small amount of resin, the presence of characteristic starch grains, some of which appear in spherical and oval aggregates, and the absence of rosette aggregates of calcium oxalate, bordered pored tracheæ and absence of lignified fibers and stone cells readily distinguish it from Jalap.

4. An assay showed this substitute to contain 2.78% of total resins.

5. It has been determined that the powdered root of *Mirabilis Jalapa* is an irritant to the skin and mucous membrane.

6. A description of the plant yielding the substitute is given.

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A Study of *p*-Nitrosothymol and *p*-Aminothymol*[†]

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Thymol because of its availability, therapeutic activity and lack of toxicity has re-

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