Since the above characters of the isolated material agree with those recorded for sucrose, the material was concluded to be sucrose.

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PSYLLIUM SEED II. SO-CALLED "ADEX PSYLLIUM."*

BY HEBER W. YOUNGKEN.

In a previous article (see JOUR. A. PH. A., 21 (1932), 1265–1271), some studies were reported that had been made by the author on commercial Psyllium seeds. Since that time he has examined many commercial samples of Psyllium including the article known as "Adex Psyllium."

Psyllium seed has become a broad commercial synonym for a variety of seeds belonging to the genus *Plantago*, many reputable dealers specifying on their labels the particular commercial variety of Psyllium by limiting adjectives preceding the noun, such as French-, Blonde-, White-, Brown-, Black-, German-, Spanish-, and some have supplemented the common commercial name with the scientific or botanical name of the plant claimed to yield the product.

During the course of the author's earlier observations on the commercial Psylliums, he came upon a package labeled "Adex Psyllium Seed." Upon examination of its contents it proved to consist of the nutlets or fruits of a Labiate, and this product was being offered as a kind of Psyllium seed. Later, he received samples of this very article by two dealers who sought his opinion on the quality of "this form of Psyllium seed."

Of course it was not a Psyllium seed at all, not even a seed, but a fruit of the Labiate which Clevenger had previously detected and reported to be yielded by *Lallemantia royleana* (1).

The plant was named after the botanist, Royle, who collected it in the province of Kanaor in India.

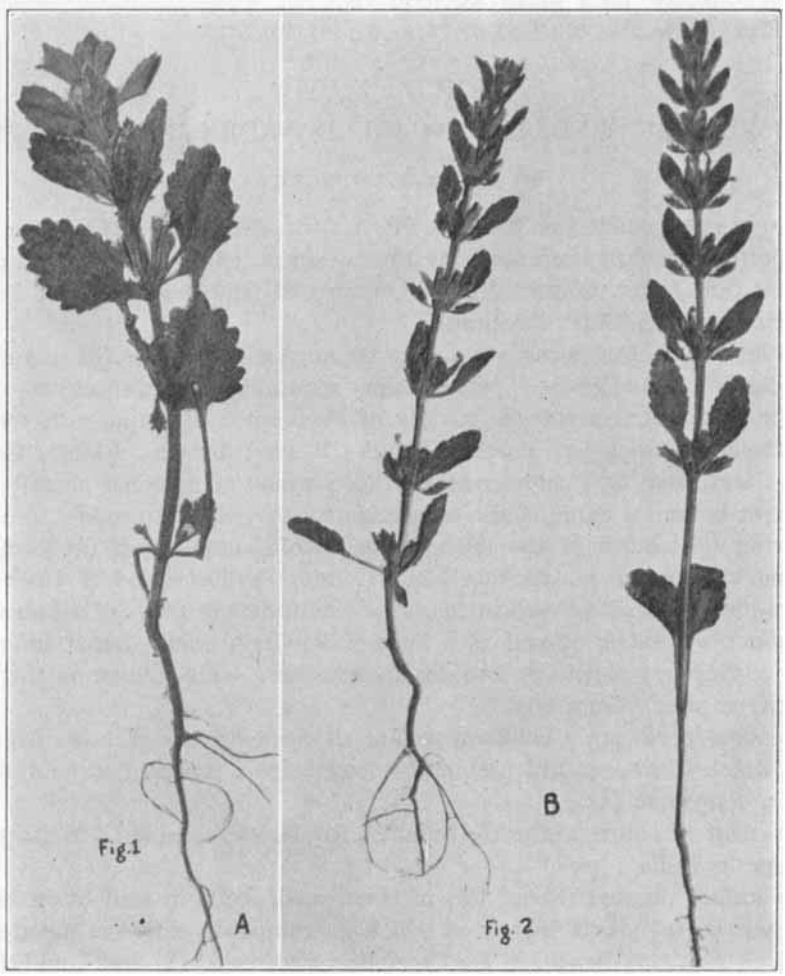
The author planted several lots of these small fruits in seed boxes and pots and reared several plants therefrom which he compared with the description of *Lallemantia Royleana* Benth. in De Candolle's *Prodromus* (2) and found the characteristics of them to tally with the statements on this species in that authoritative work.

DESCRIPTION OF LALLEMANTIA ROYLEANA, BENTHAM.

An annual herb native to India and Persia attaining a height of from 5 to 18 inches. Stem quadrangular, simple to branched, glabrate at base, softly villose beyond and pubescent at the apex. Foliage leaves opposite, ± cordate below, petiolate, green, base of the lower cuneate, of the upper narrowed into petiole; margin of lower leaves crenate; inflorescence a long, interrupted spike-like raceme of verticillasters; bracts small petiolate; flowers small, tubular-bilabiate the calyx green, pubescent, 5-toothed and striate; the corolla pale purple to blue with a slender tube and a 2-lipped limb; fruits 4 dull black, oblong-ovate nutlets; seed exalbuminous.

* Scientific Section, Madison meeting, August 1933.

Plants grown by the writer from commercial "seed" were in flower in late July. They varied from 12 to 30 cm. in height. The foliage leaves were petiolate, the lower up to 4 cm. in length, the lamina cordate, up to 2 cm. long and 1 cm. broad, the apex obtuse, the base cuneate, margin crenate and surface villose. The upper foliage leaves were oblong-ovate, spatulate to lanceolate with mucronate



Figs. 1 and 2.—Flowering plants of *Lallemantia Royleana* Benth. grown from two lots of so-called "Adex Psyllium seed."

apex, attenuate base and dentate to serrate margin. The bracts were oblong, sharply serrated, the teeth terminating in long, lilac-colored bristles. The flowers were tubular-bilabiate, each with a green, slender, tubular calyx 5 to 6 mm. long, possessing 15 villose ribs and a lilac to purplish blue, tubular bilabiate corolla.

PHYSICAL CHARACTERISTICS OF FRUITS.

When examined under a lens the nutlets are oblong-ovate, dull black to dark brown (immature fruit) with a light brown edge when examined over a surface illuminated from below, with a dorsal convex surface and two plane or slightly concave ventral surfaces, the latter sepa-

rated by a longitudinal ridge which extends to a cream-colored, elevated, saddle-shaped hilum at the narrow end, 3 to 3.5 mm. long and 1 to 1.2 mm. wide, internally the cut surface showing a narrow black pericarp and a large gray to bluish gray oily seed; odor indistinct; taste sweet and mucilaginous upon mastication.

HISTOLOGY OF FRUITS.

Cross and surface sections were cut in cork and paraffin and separately examined in water, iodine water, phloroglucin-HCl, picric acid and in xylol mounts under a compound microscope. A cross section cut through the middle region of the fruit exhibits an irregular, triangular outline with rounded angles, one convex side and two more or less concave sides.

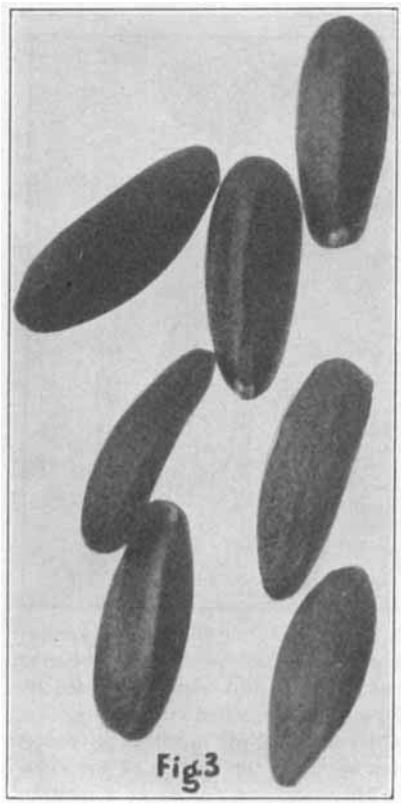


Fig. 3.—Fruits of *Lallemantia Royleana* offered on the American market as "Adex Psyllium" and more recently as a "Black Plantago Psyllium seed." Photomicrograph × 10.

Pericarp.—This consists of an epidermis and a brownish black pigment layer. The epidermis is mucilaginous, from 21.24 to 32 microns in radial breadth, its cells showing prominent, thick radial walls, outer walls which are thin in the middle and thickened toward the radial walls and thin, inner walls. Many of the outer walls appeared missing. The radial walls of adjacent cells terminate in shallow saucer or cup-shaped structures which give them the appearance of long-stemmed goblets or peltate structures. The lumina of these epidermal cells are filled with cell content mucilage.

When mounts of dry cross sections are irrigated with water, the outer walls of the epidermal cells burst and long, laminated finger-like processes of mucilage quickly protrude. The mucilaginous processes extend from the inner wall of each of the epidermal cells and project outward between the jagged cup-like ends of the radial walls for a considerable distance beyond the margin of the section. The pigment layer contains dark brown amorphous matter.

Seed.—Beneath the pericarp and adhering thereto is the seed coat which is composed of outer brown, narrow, palisade cells and inner brown, irregular to stellate cells, the latter having long, slender processes.

The embryo, consisting of 2 large fleshy cotyledons and a hypocotyl, fills up the large central part of the seed. Its small parenchyma cells possess thin walls and contain minute aleurone grains and fixed oil droplets, but no starch.

BEHAVIOR OF ENTIRE FRUITS IN WATER.

When 1 Gm. of the entire fruits was placed in a 50-cc. graduated cylinder, water added to the 50-cc. mark and the contents agitated at intervals during 24 hours, at the expiration of which time the total volume occupied by the swollen fruits was noted, the final reading showed the swollen fruits occupied a volume up to the 40-cc. mark. In 48 hours the volume occupied was 47 cc. The fruits, enveloped in mucilage, tended to cohere.

When entire dried fruits are examined in water under the compound microscope, the epidermis swells, the outer walls burst, liberating numerous finger-like processes of mucilage which later coalesce, forming a bluish tinged mucilage which tends to adhere tenaciously to the fruits. Within 24 hours after a fruit has been

macerating in water, the mucilaginous exudate adherent on its outer surface occupied an area of at least six times that of the fruit included within it. As noted above in the sections, so also in the entire fruit, the radial walls of the epidermal cells appeared as long-stemmed goblets whose terminal cups frequently showed jagged margins. The mucilage at the end of this period appeared as irregular, interrupted, radiating strings.

Recently the writer has been informed by a friend at Collegeville, Pa., of a serious case of illness following ingestion of a drug answering the description of this one. From the tendency of the fruits to cohere, and from the microscopical studies of the outer fruit wall after maceration in water, as aforementioned, it

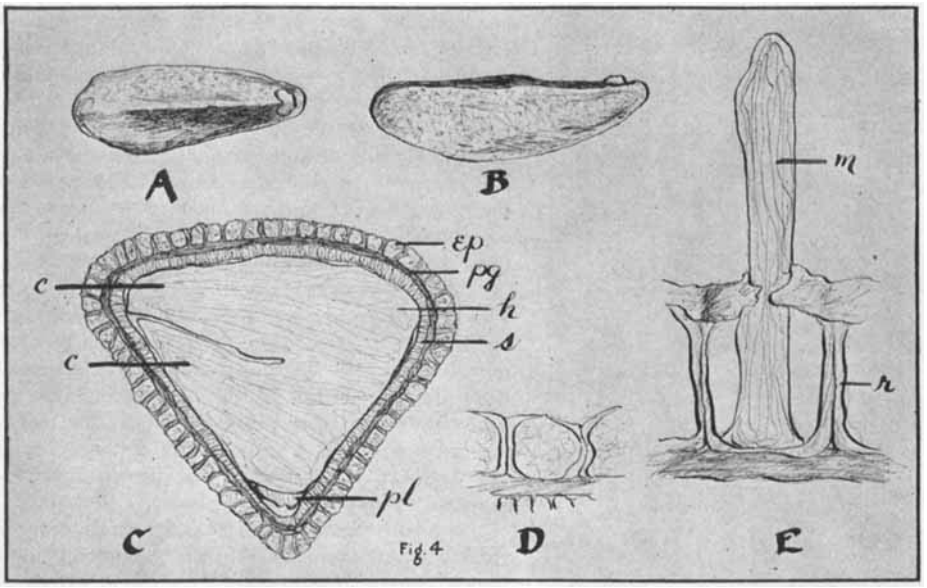


Fig. 4.—Fruit of *Lallemantia Royleana*, commercially known as *Adex Psyllium*. A, ventral surfaces. B, dorsal convex surface and portion of one of the ventral sides. C, transverse section, showing epidermis (*ep*) and pigment layer (*pg*) of pericarp, seed coat (*s*), cotyledons (*c*) and hypocotyl (*h*) of embryo, and placenta (*pl*). D, a more magnified view of a portion of the epidermis and subjacent tissue in cross section of dry fruit. Note mucilage in epidermal cell and radial walls with middle lamellæ. E, view of the outer portion of the cross section of the fruit directly after irrigation of mount with water. *m*, mucilage; *r*, peltate structure formed of radial and outer walls of adjacent epidermal cells.

is conceivable how such could follow. When taken into the intestine, it is probable that intestinal movements caused formation of a bezoar mass with the rigid, peltate projections of epidermis of the fruits interlocked, occluding the passageway.

CONCLUSION.

While mucilage of fruits of *Lallemantia Royleana* may be found of some service in the arts, if means for properly separating it can be devised, the writer is of the opinion that the internal administration of this fruit to man or beast is dangerous.

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MASSACHUSETTS COLLEGE OF PHARMACY, August 15, 1933.