he might be he would have the same tincture to deal with. That was carried out partially. The Government assembled six hundred pounds at Minneapolis and six thousand pints of tincture digitalis was made from that one single lot. But unfortunately it did not supply the whole Army. Previous to this on testing again and again specimens for the Army in different camps, I could find no activity, and they could not get any effect, and that was simply because the digitalis was of inferior grade.

AMBROSE HUNSBERGER: I am in sympathy with Dr. Hatcher's suggestions because the question of digitalis has been one that interested me particularly during the past year. I was also interested in Professor Kraemer's statement regarding the digitalis that he grew, comparing it with the digitalis on the market at the present time. I was wondering whether he compared it with the digitalis that he bought on the market during the past year or whether he found it two or three times as strong as the U. S. P. standard.

OBSERVATIONS ON DIGITALIS SIBIRICA.*

BY HEBER W. YOUNGKEN.

About two years ago, the writer received a number of samples of medicinal plant seeds from the Bureau of Plant Industry of the United States Department of Agriculture. Among these was a generous supply of the seeds of *Digitalis Sibirica* Lindley.

Some of these seeds were sown in a seed pan in the greenhouse of the Philadelphia College of Pharmacy. They were found for the most part viable, for ere long they germinated into a goodly number of seedlings. These seedlings were later transplanted to boxes on the roof garden containing ordinary garden soil. Here they thrived so well, forming, in most instances, a good rosette of leaves at the end of the season, that his attention became more concentrated upon them.

He next conceived the idea of determining how the pharmacodynamic properties of their leaves compared with those of *Digitalis purpurea* Linne. The results of a biologic assay, performed by testing the tincture of the leaves (prepared in accordance with the U. S. P. method prescribed for Tincture of Digitalis) on normal frogs at a temperature of 22° C. by the one-hour frog method, showed the tincture to be three-quarters over the strength required for the U. S. P. Tincture of Digitalis. Moreover, in every case where the dose was toxic, the heart was found to have stopped in systole. The last effect is the same as has been recorded for all the members of the Digitalis series of cardiac tonics.

As yet he has not had the opportunity to study the pharmacotherapy of the leaves, but, judging from the results of the biologic assay, they may later be found at least as efficient as those of *Digitalis purpurea* L.

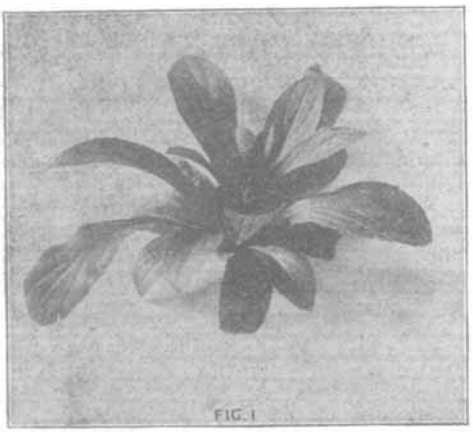
Upon searching the literature for botanical references, only one of any value could be found. This was a short article by Lindley in "Digitalium Monographia" published in 1821, in which he pictures the plant in colors, mentions a few of its macroscopic characteristics, and states that its habitat is Siberia and Tartary.

The meagre data on this plant up to the present, linked with the facts that it is so easily grown and has strong prospects, on account of its pharmacodynamic properties, of becoming one of our valued cardiac tonics, inspired the writer to make a botanical investigation, the results of which are hereby presented.

*Read before Scientific Section, A. Ph. A., New York meeting, 1919.

MATERIALS.

The material used in this investigation included seeds and first and second year plants of *Digitalis Sibirica* Lindley. The seeds were procured from Dr. W. W. Stockberger of the Bureau of Plant Industry, United States Department of Agriculture. From these were raised first and second year plants in ordinary garden soil, on the roof garden of the Philadelphia College of Pharmacy. Additional material in the shape of leaves and plants of the second year's growth was furnished by the Bureau of Plant Industry from its Arlington farms. A part of this material was studied in its natural condition, a part pickled in 50% alcohol for additional observation, and the balance made up into tincture. The leaves employed in the biologic assay (*vide supra*) were obtained from plants of the first year's growth. They were air-dried by placing them in weak sunlight for four consecutive days, at the end of which period they were perfectly dry. The leaves were then ground to a No. 60 powder and a tincture prepared from them in accordance with the U. S. P. IX method prescribed for Tincture of Digitalis.



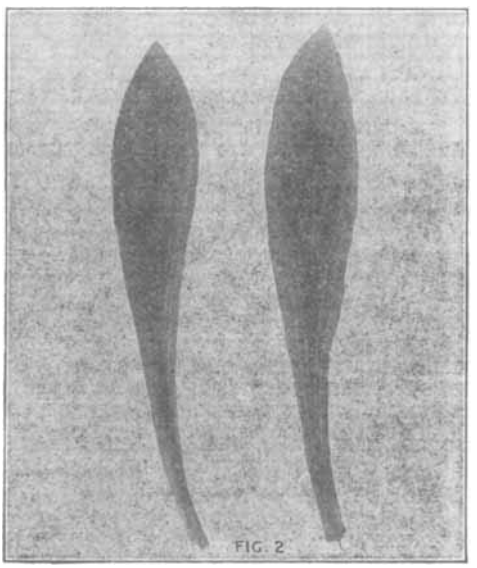
Digitalis Sibirica, Lindley.—Aerial portion of first year's growth.

DESCRIPTION OF PLANT.

Digitalis Sibirica Lindley is a biennial plant indigenous to Siberia and Tartary, but readily adapting itself to cultivation in the latitudes of Washington and Philadelphia. From an underground fibrous root system, there appears, before the close of the first season, a rosette of leaves showing the following macroscopic characteristics: Oblanceolate; 6 to 14 cm. in length, 2 to 5 cm. in breadth; summit mucronate; base somewhat cuneate, tapering into a winged petiole, 2 to 6 cm. long; margin, coarsely serrate in upper portion, becoming distantly serrate in lower; upper surface dark green, becoming on drying olive-green, lower surface paler green, nearly glabrous; venation, pinnate-reticulate, midrib prominent and brown, the brownish veins of the first order slightly elevated and diverging from the midrib at angles of 23° to 33°, anastomosing near the margin; very slightly pilose along veins, particularly in the lower part of lamina and along the margin of the petiole; texture membranous becoming fragile upon drying; taste bitter; odor resembling but fainter than leaves of *D. purpurea*.

During the early autumn of the first year the leaves perish, but the root system lives over the winter. The following spring it becomes more extensive, producing numerous additional branches. During this same season an aërial stem sprouts forth which elongates until by mid summer it may attain a length of 6 dm. This stem bears several branches. Both main stem and branches are green, sparsely hairy and quadrangular with prominent ridges between the angles. These bear foliage leaves below and green bracts and flowers above. The foliage leaves have

the following characteristics: Oblanceolate and winged petiolate and more or less crowded below, resembling the leaves of the first year's growth, oblong-ovate to ovate lanceolate above, becoming gradually shorter toward the summit of the inflorescence; alternate; 6 to 17.5 cm. in length, 2 to 4 cm. in breadth; exstipulate; apex acute or mucronate; base somewhat cuneate; margin, serrate above, becoming distantly serrate, sometimes denticulate, and usually entire toward the base; upper surface dark green, both surfaces only slightly pilose; venation pinnate-reticulate, midrib prominent and brown, the veins of the first order diverging at angles of 23° to 40°, anastomosing near the margin; texture membranous to subcoriaceous; taste bitter; odor resembling but fainter than the leaves of *Digitalis purpurea*.



Digitalis Sibirica, Lindley—Two leaves from first year's rosette, ventral aspect (*a*), dorsal aspect (*b*).

The inflorescence is an elongated raceme which bears numerous bracts and yellow, tubular, drooping, slightly irregular flowers. The bracts are foliage-like below but gradually diminish in size as the inflorescence axis is ascended, until near the summit they become only 4 mm. long and 1 mm. broad. The hermaphrodite flowers are borne singly on the ends of villose pedicels. The calyx is composed of 5 slightly gamosepalous sepals which are subulate and villose. The corolla consists of a yellow inflated, gamopetalous, hirsute tube with a projecting lower lip. The upper lip and portion of inner surface are marked with purplish red spots. The androecium consists of four didynamous stamens with good anthers. The gynoecium is bicarpellate and consists of a two loculed ovary with central placenta, bearing numerous small ovules, an elongated terminal style and a bilobed stigma. The fruit is a two-celled woody capsule 10 to 13 mm. in length, with calyx adherent. The seeds are small, numerous, brown in color, and richly albuminous.

The second season's growth of the plants under cultivation in Philadelphia died to the ground about the middle of July. From the root system there then sprang forth a rosette of long, light green lanceolate leaves. Whether another floral stem also arises, the writer has not yet been able to determine. No evidence of the same has appeared up to August 9th.

HISTOLOGY OF THE LEAF.

Dorsoventral and surface sections of the leaf show the following microscopic peculiarities:

The upper epidermis is composed of a layer of cells which vary in outline from rounded to ovate to somewhat elongated, as observed in dorso-ventral sections. The outer walls of these cells are more or less convex and covered by a thickened

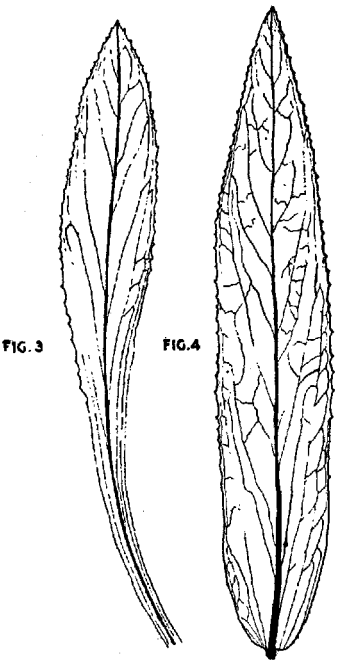


FIG. 3

FIG. 4


FIG. 9

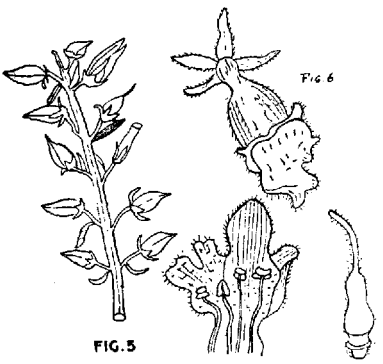


FIG. 5 FIG. 7 FIG. 8

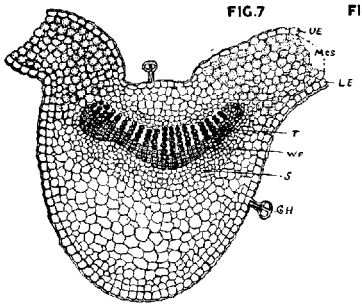


FIG. 10

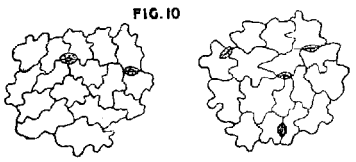


FIG. 11 FIG. 12

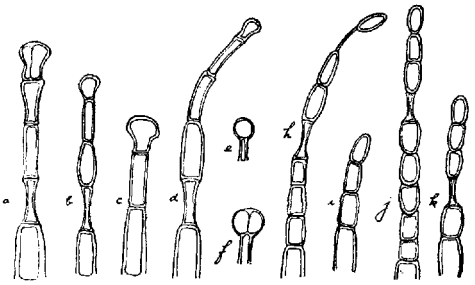


FIG. 13

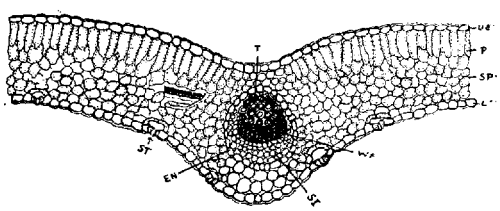


FIG. 14

Fig. 3.—Leaf from basal portion of stem of second year's growth of *Digitalis Sibirica*. Note the winged petiole. Fig. 4.—Leaf from portion of stem higher up of *Digitalis Sibirica*. Fig. 5.—Terminal portion of inflorescence of *Digitalis Sibirica*. Fig. 6.—Flower of *Digitalis Sibirica*. Fig. 7.—Corolla tube dissected, showing stamens within. Fig. 8.—Pistil of *Digitalis Sibirica*. Fig. 9.—Fruit of *Digitalis Sibirica* in process of dehiscing (*a*); valves of same separated exposing septum, placenta and seeds (*b*). Fig. 10.—Transverse section through midrib region of leaf of *Digitalis Sibirica* showing upper epidermis (UE), lower epidermis (LE), mesophyil (MES), tracheae (T), wood fibers (WF), leptome (S) and glandular hair (GH) (highly magnified). Fig. 11.—Surface view of portion of upper epidermis of leaf of *Digitalis Sibirica* (highly magnified). Fig. 12.—Surface view of portion of lower epidermis of leaf of *Digitalis Sibirica* (highly magnified). Fig. 13.—Several types of glandular hairs found on leaves of *Digitalis Sibirica* (*a, b, c, d, e, f*); various forms of non-glandular hairs found on same (*h, i, j, k*) (highly magnified). Fig. 14.—Transverse section of portion of lamina outside of midrib of leaf of *Digitalis Sibirica*, showing upper epidermis (UE), palisade parenchyma (P), spongy parenchyma (SP), lower epidermis (LE), stoma (ST), trachea (T), wood fibers (WF), sieve tissue (SI), and endodermis, surrounding fibrovascular tissue of vein (EN) (highly magnified).

cuticle which appears to be crenulated along the outer margin. The vertical walls of the epidermal cells are wavy, as observed in surface view. Scattered here and there amongst the regular epidermal cells are slightly elevated stomata which appear in the material examined to be more numerous on this epidermis of the lower leaves than on the upper ones.

The cells of the lower epidermis are similar in character to those of the upper epidermis but many more stomata are evident. Glandular and non-glandular hairs are present on both lower and upper epidermis as outgrowths of individual cells. They are present in fewer numbers on the upper than on the lower epidermis. The glandular type appears to predominate. There are four kinds of these, *viz.*: (1) a one-celled stalk and a one-celled glandular head, (2) a one-celled stalk and two-celled glandular head, (3) a uniseriate stalk and a one-celled glandular head, and (4) a uniseriate stalk and a two-celled glandular head. The second type far outnumbers the others. The third type attains a length of 356.5 μ.

The non-glandular hairs appear less abundant along the margin of lamina and petiole but never in large numbers such as are found in *D. purpurea*. As in *D. purpurea* certain cells in the course of the hairs frequently have collapsed walls. The length of these hairs appears to range from 65 μ to 564 μ.

The mesophyll between upper and lower epidermis is differentiated into upper palisade and spongy parenchyma regions. The palisade region consists of a zone of long and short columnar shaped cells, one to two layers thick, which, in the regions of the midrib and stronger veins, become more or less spheroidal in character. The spongy parenchyma region consists of more loosely arranged irregularly spheroidal to spheroidal shaped cells with prominent intercellular spaces between various components. Through this region course branched collateral fibro-vascular bundles, each of which is surrounded by a distinctly clear endodermis. In these bundles xylem is uppermost, phloem beneath. The spiral type of trachea predominates in the xylem. The phloem is entirely devoid of bast fibers.

The midrib contains a broad somewhat semilunar-shaped area of fibro-vascular elements in which xylem is uppermost, phloem beneath. The xylem region contains chains of radically arranged spiral and pitted tracheae and thick walled, angular, wood fibers. The latter are always beneath the tracheae. The phloem is crescent-shaped and devoid of bast fibers. No sclerenchyma arc is present. The parenchyma cells above and below the fibro-vascular area are pitted, for the most part clear, and of rounded to polygonal outline. Occasionally, by no means always, those near the upper and lower epidermis and above and below the fibro-vascular region become slightly collenchymatic. The mesophyll cells of the lamina immediately adjacent to the midrib are not differentiated into palisade and spongy parenchyma.

HISTOLOGY OF THE STEM.

When examined microscopically, this organ shows the following characteristics, passing from periphery toward the center:

1. A protective epidermis whose cells, as seen in transverse view, vary from irregularly spheroidal to slightly tangentially elongated, with convex outer and inner walls and which, when examined in surface view, possess irregularly rectangular to elongated polygonal outlines. The outer walls of these cells are cutinized,

the cuticle in transverse view attained a thickness of 10μ. Stomata are found here and also a scattering of glandular and non-glandular hairs.

2. A cortex of varying thickness, depending upon the age of the portion of stem examined, and consisting of more or less tangentially elongated cortical parenchyma cells with simple pored walls and small to moderate sized, angular intercellular-air-spaces. The cortex cells become larger then smaller as the pericycle is approached.

3. A pericycle consisting for the most part of an irregular, interrupted circle of sclerenchyma fibers with strongly lignified walls, varying at different points in thickness from one to two or three layers of cells.

4. A phloem composed of sieve tubes, companion cells, and phloem parenchyma, but no bast fibers. Narrow, thin walled medullary rays separate this region into numerous patches.

5. A cambium of meristematic cells, forming an irregular circle.

6. A xylem about three and a half times as broad as the phloem region and composed of closely set radially arranged groups of wood fibers and spiral and pitted tracheae, separated by narrow medullary rays (1 cell wide) whose walls, like those of the wood fibers and tracheae are strongly lignified. The outer region of the xylem arms is composed for the most part of woody fibers with but few tracheae. The tracheae gradually increase in number until the inner portions of the arms show more of those structures than wood fibers.

7. Conjunctive tissue composed of cells having lignified, pitted walls separates the xylem from the next region or,

8. Pith, a broad central zone of more or less isodiametric to elongated parenchyma cells with pitted walls. Some of these cells, especially in the outer region, have lignified walls.

HISTOLOGY OF THE ROOT.

This organ, in its secondary growth, shows the following structural peculiarities, passing from periphery toward the center:

1. Several layers of tabular cork cells with brownish walls.

2. A cork cambium of meristematic cells.

3. A secondary cortex of numerous layers of tangentially elongated more or less parallel phloem patches, composed of sieve tubes, phloem cells and companion cells, alternating with narrow phloem medullary rays.

4. A cambium of irregular circular outline, composed of meristematic cells.

5. A xylem, comprising a broad central porous cylinder of numerous narrow xylem arms alternating with medullary rays, one cell wide. Each xylem arm is composed of many spiral and pitted tracheae, wood fibers with oblique slits in their walls, and wood parenchyma cells. All of the xylem elements have lignified walls.

MAINTAINING FROGS FOR TEST PURPOSES.*

BY L. W. ROWE.

The proper maintenance of a supply of normal frogs throughout the year, when fresh supplies are not available daily, requires special facilities to avoid excessive losses and to insure uniform results when standardizing preparations of heart tonics of the digitalis series by the frog methods.

The chief source of trouble lies in the variation in temperature of the water in which the frogs are stored. In the summer the tap-water in the mains rises to 24° and 27° C., which is too warm, causing epidemics of disease to flourish among

*Read before Scientific Section, A. Ph. A., New York meeting, 1919.