Contributed and Selected

THE PHARMACOGNOSY OF THE MEDICINAL RHAMNUS BARKS.

E. N. GATHERCOAL, PH. G.

(Continued from page 207.)

RHAMNUS CALIFORNICA BARK.

(The fresh material used for this study was kindly supplied by Dr. Albert Schneider and Mr. Theodore Payne of California.)

The sections from the terminal bud exhibit a total diameter of 2 mm. of which the pith constitutes one-half, the bark 400 microns on either side and the wood circle 100 microns. The structure corresponds very closely with that of similar sections from *Rhamnus purshiana.* The mucilage sacs are especially abundant in the pith, occupying about two-thirds of the total area and apparently containing large rosettes of calcium oxalate, 30 to 60 microns in diameter, embedded in the mucilage. The contents of the pith parenchyma cells are purplish-brown in color.

In sections just below the bud the collenchyma of the outer portion of the middle bark is more distinctive than in the *Rhamnus purshiana.* Few mucilage cells are found in bark or pith, but large rosettes are very abundant and the primary bast is becoming differentiated as an almost continuous band. The phloem parenchyma cells often contain dark brown or purplish contents, as indeed do nearly all the parenchyma cells of the bark except the crystal cells. The cambium is evident and the wood circle is 200 to 300 microns wide.

At 15 mm below the bud the structure is very similar to that of *Rhamnus purshiana.*

In a four-year-old stem the bark exhibits the first evidences of secondary bast, and as yet no stone cells are present in the middle bark. The strongly differentiated character of the collenchyma is very evident.

Sections from the mature bark show a structure strikingly like that of Rhamnus Purshiana.

No distinction in the character of the cork layer could be determined in the two barks.

The collenchyma of *Rhamnus californica* bark observed in specimens from several plants, is larger celled than in Rhamnus Purshiana, these cells reaching a maximum of 100 microns tangentially by 20 microns radially, but averaging about 45 microns by 12 or 15 microns, the walls much thickened. The masses of stone cells in the middle bark are very similar in the number, size and character of their cells to those in similar sections of Rhamnus Purshiana. Rosettes are very abundant and the smaller prismatic crystals plentiful.

In the inner bark the secondary bast is similar to that of Rhamnus Purshiana, strands rather fewer-celled and the fibers somewhat smaller. In inner bark 1 mm. in width, there are 6 tangential rows of bast. The medullary rays in transverse section, are from 1 to 5 cells wide, but mostly 2 and 3 cells wide. In a section 6.7

mm. long there were 28 rays, 4 of them 1 cell wide, 12 of them 2 cells wide, 10 of them 3 cells wide, 1 of them 4 cells wide and 1 of them 5 cells wide. In tangential view the rays are rather broadly elliptical, mostly 3 or 4 cells wide (60 to 100 microns) and from 10 to 30 cells long (150 to 500 microns). The widest I observed was 5 or possibly 6 cells wide, though Farwell found them 7 cells wide. As to the frequency of the rays in the two barks, they are undoubtedly more frequent in the Rhamnus Purshiana. In an average section of Rhamnus Purshiana there were 46 rays in 7 mm. as against 28 rays in 6.7 mm. of *Rhamnus californica* bark. The ray cells in transverse section are sometimes slightly elongated radially, again nearly square and again slightly elongated tangentially. In tangential view they are mostly rounded or irregular. Crystals are not present in the rays.

The waviness of the cambium edge, observed in transverse section, due to a shrinking inward at each medullary ray is a striking feature. It is best seen in rather thick sections of the bark, which has been dried and then softened in dilute alcohol, and mounted in water or phloroglucin and hydrochloric acid. But even in thin sections swollen in potassium hydrate solution this feature may yet be observed. The waviness is not seen in sections of the bark attached to the wood nor in very young bark that has been dried and afterwards softened. It was observed, however, in bark 4 years old.

Potassium hydrate solution colors at once the contents of the medullary ray cells a pinkish-red for a short distance inward from the cambium, and also the phloem parenchyma of the latest growth. After a few minutes, especially in sections cut from dried bark, and mounted directly in the potassium hydrate solution, the entire inner bark with the exception of the bast acquires the pinkish color.

RHAMNUS CAROLINIANA BARK.

(The material for this study was obtained from the Biltmore Nurseries of Biltmore, N. C., and from living plants in the author's garden in Oak Park.)

In transverse sections from the base of the bud of a width of 2.7 mm., the bark constitutes 540 microns and the wood circle 180 microns either side and the pith has a diameter of 1.17 mm.

The structure of these sections is very similar to sections from the base of the bud of *Rhamnus purshiana*. The epidermis consists of small, nearly cubical brown cells with some one-celled, curved or wavy trichomes.

In the middle bark, the outer portion consists of about 8 rows of small rounded parenchyma cells with living contents including chlorophyll grains. The inner portion consists of parenchyma cells containing vast numbers of rosette aggregates of calcium oxalate and with very many mucilage sacs imbedded in it.

The inner bark is narrow and consists of an outer layer of small-celled phloem and a rather wide typical cambium.

The wood circle is like that of *Rhamnus purshiana*.

The pith contains 14 mucilage sacs, the largest 450 microns across and the total occupying two-thirds of the area of the pith. Many rosette aggregates are present in the parenchyma.

In a three-year-old stem, 30 cm. below the terminal bud, measuring 6.5 mm. across, the bark constituted .65 mm. on either side.

The cork was 8 to 10 rows of cells (100 microns) in width, the cells closely resembling those of *Rhamnus purshiana*.

The middle bark is 450 microns wide, the outer portion of collenchyma, the inner portion of typical parenchyma, with a few small mucilage sacs and some rosettes. Small scattered bundles of unlignified primary bast lay at the inner edge. No stone cells are present.

The inner bark is narrow. No secondary bast has been formed.

Sections of the bark from a stem 15 mm. in diameter and 5 years old were 1 mm. wide, of which the cork layer constituted about 100 microns, the middle bark 400 microns and the inner bark 500 microns. The cork was roughened and flaked and in patches up to 18 rows of cells thick.

In the middle bark, the largest mass of stone cells observed was 300 microns long. The stone cells show pores, stratifications and lumen quite distinctly.

The inner bark contains 1 or 2 rows of small bast bundles, typically like the early *Rhamnus purshiana* bundles. The medullary rays are elliptical in tangential view, the widest observed being 4 cells wide, but mostly 2 and 3 cells wide. They are rather short, the longest observed being 20 cells long. The ray cells are mostly square or slightly elongated radially. The rays are numerous, 30 rays in a transverse section 3.4 mm. long, thus being twice as numerous as in *Rhamnus californica* bark and a half again as numerous as in *Rhamnus purshiana* bark.

No evidence of a waviness along the cambium edge was observed.

With potassa solution, the parenchyma cells of the inner bark acquire a pink-red color.

RHAMNUS WIGHTII BARK.—(After Hooper.)

Masses of stone cells are found in the middle bark and rosette aggregates of calcium oxalate crystals are abundant in the parenchyma cells.

The inner layers consist of pale yellow bast fibers running through a mass of cells containing yellow brown color. The bast bundles are surrounded by numerous rhomboidal crystals. The medullary rays and inner cellular layers are filled with starch and a yellow coloring matter acquiring a brilliant red with potash solution.

RHAMNUS FRANGULA BARK.

(The fresh material used for this study was collected in the dormant season from cultivated plants in the south parks in Chicago and in the author's garden in Oak Park, Illinois.)

The sections obtained from the terminal bud correspond very closely with those

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(Detail of cuts on succeeding page.)

RHAMNUS FRANGULA AND RHAMNUS CATHARTICUS.

Fig. 23—Transverse section of the bark from a 9-year-old stem of *Rhamnus frangula*. A—outer bark, B—middle bark, C—inner bark. 1—cork, the outermost rows compressed; 2—collenchyma; 3—middle bark parenchyma with numerous rosettes of calcium oxalate crystals; 4—the earliest secondary bast; 5—secondary bast of later growth with accompanying crystal fibers; 6—phloem consisting mostly of parenchyma with some rosettes of calcium oxalate; 7—medullary ray, practically free from crystals; 8—cambium. (X 200, reduced ½.)

Fig. 24—From the inner bark of *Rhamnus frangula*, in transverse view. 1—bast fibers; 2—crystal fibers; 3—phloem parenchyma, one cell showing a rosette aggregate, another with living cell contents and a third with pores in the bottom wall. (X 600, reduced ½.)

Fig. 25—The inner bark of *Rhamnus frangula* in tangential view. 1—medullary ray; 2—phloem parenchyma; 3—bast fibers; 4—crystal fibers. (X 600, reduced ½.)

Fig. 26—Transverse section of the bark *Rhamnus catharticus* from a 4-year-old stem. A—outer bark, B—middle bark, C—inner bark. 1—cork, many rows of narrow cells much elongated tangentially; 2—collenchyma of a few poorly differentiated rows; 3—parenchyma with some calcium oxalate rosettes; 4—unlignified primary bast; 5—lignified secondary bast with crystal fibers; 6—phloem parenchyma; 7—medullary ray; 8—cambium. (X 200, reduced ½.)

Fig. 27—Tangential view from the outer and middle barks of *Rhamnus catharticus*. 1—cork; 2—phellogen; 3—parenchyma with rosette aggregates; 4—primary bast in interweaving strands .(X 600, reduced ½.)

Figs. 28 and 29—Tangential views from the inner bark of *Rhamnus catharticus*. 1—medullary ray; 2—bast fiber; 3—crystal fiber; 4—phloem parenchyma with strongly beaded walls and occasional rosettes of calcium oxalate crystals. (X 600, reduced ½.)

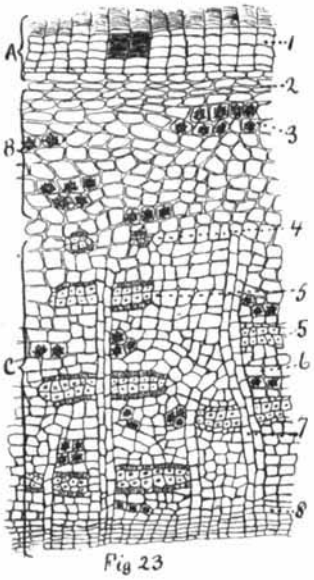

Fig 23

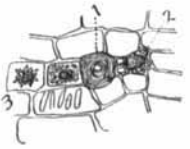

Fig. 24

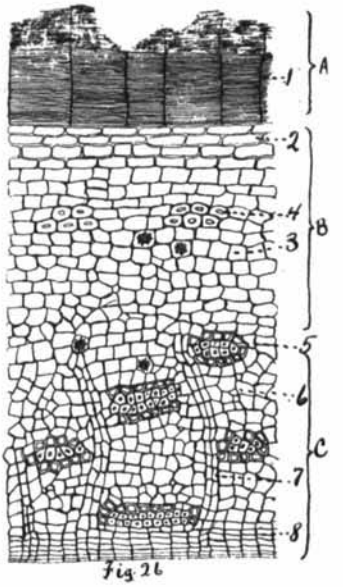

Fig 26

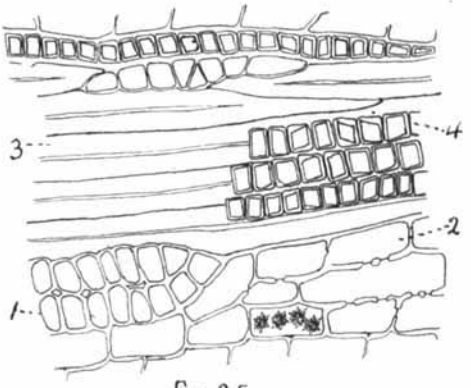

Fig. 25

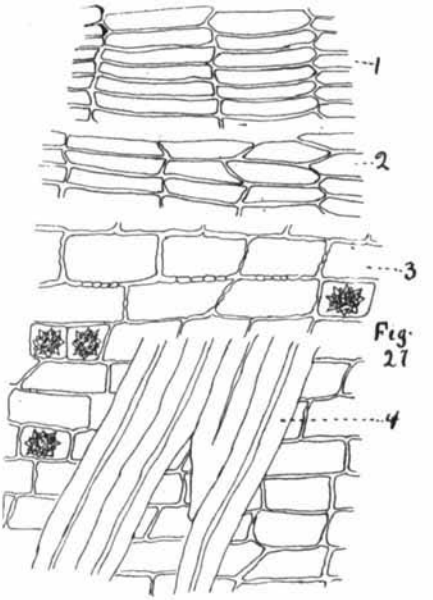

Fig. 27

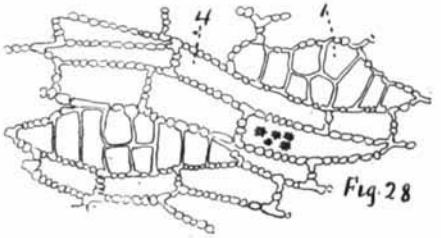

Fig. 28

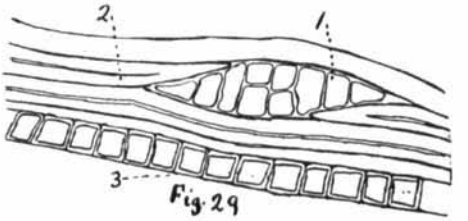

Fig. 29

from *Rhamnus purshiana* bark, likewise no distinctions could be made in sections from each plant just below the bud, except possibly a somewhat less number of mucilage sacs and of rosette aggregates of calcium oxalate in the *Rhamnus frangula.* It is noteworthy, however, that already, in these sections from the base of the bud, cork has made its appearance, for in some portions of the section three layers of typical cork cells were present beneath the epidermis, in other portions none, though a phellogen can be distinguished throughout the whole circumference. The cork cells are mostly 15 microns tangentially, 8 to 10 microns radially, thin walled, the outer row with the walls red-brown in color.

In sections 2 mm. below the bud, the epidermis, with the abundant brown trichomes; the parenchyma, mucilage sacs, unlignified primary bast and rosette aggregates of the middle bark; the thin phloem layer and the medullary rays of the xylem all correspond with similar tissues in similar sections of *Rhamnus purshiana.* The brown-walled cork is in a continuous layer 3 to 5 cells wide.

At 5 cm. below the bud, the outer bark is 50 to 90 microns wide, the middle bark 200 microns across, the inner bark 160 microns wide, the wood circle 360 microns wide and the pith 1170 microns in diameter: total diameter of the stem 2.75 mm. There are no changes of note except a slight thickening of the cork, phloem and xylem layers. The medullary rays of the wood are lignified.

At 15 cm. below the bud the wood is of two seasons' growth, the width of the xylem circle being nearly 1 mm., the pith 1 mm. in diameter and the bark nearly ½ mm. thick. There are practically no changes in the bark. In another specimen from a three-year-old stem of a total diameter of 4.5 mm. the cork is irregular, up to 100 microns thick, the middle bark is 200 microns thick and the inner bark 200 microns thick. No secondary bast nor stone cells are present.

In a four-year-old stem the first evidence of secondary bast is found.

In a nine-year-old stem sectioned through a lenticel, the bark measures 1.07 mm. in thickness, of which 240 microns is outer bark, 200 microns middle bark and 630 microns is inner bark. The outer bark consists of exfoliating layers of small dark red cork cells intermixed with colorless cork cells and of a typical lenticel structure. The middle bark of parenchyma contains interweaving strands (one circle only) of non-lignified primary bast. No stone cells are present. The inner bark contains 5 irregular circles of bast bundles with the accompanying crystal fibers. The medullary rays as seen in tangential view are either a single row of cells or a narrow biconvex mass 2 or 3 cells wide. Small rosette and prismatic crystals in the parenchyma are very abundant. A few starch grains 3 or 4 microns in diameter are found in the parenchyma of medullary ray, phloem and middle bark.

Samples of the commercial drug gave sections very similar to the ones just described. The outermost layer of brown cork is seen to consist of several rows (8 to 20) of small rectangular cells, many with purplish contents, arranged one behind another in regular radial rows. The middle bark is of rounded or oval parenchyma cells with rather thin cellulose walls and granular contents and, it is worthy of note, that the parenchyma cells in the dried, cured bark often possess deep brown or purplish-brown contents. Many prismatic crystals and rosette aggregates are found in the cells of this layer. The inner bark is traversed radially by the rather numerous, nearly straight medullary rays up to 3 cells wide and

longitudinally by the conspicuous bast bundles with from 2 or 3 to 30 or 40 bast fibers in each. The individual fibers are narrow, thick walled, the cavity but a line and strongly lignified. Adherent to each bundle of bast are the typical crystal fibers.

Powdered Frangula, macroscopically, very closely resembles powdered Cascara, for in many samples of each powdered drug observed, the resemblance in color, odor and taste was so striking that they could not be differentiated by these means. Microscopically, nearly all the tissues in powdered Frangula closely resemble the corresponding tissues in powdered Cascara, though there is one very characteristic tissue, the stone cells, in Rhamnus Purshiana not present at all in Frangula. Therefore, it is not difficult to distinguish between these powders when separate, nor to detect Cascara in Frangula. It is somewhat more difficult to detect Frangula admixed with Cascara. However, the purplish contents of many of the cork cells of Frangula give to most of the fragments of cork, especially in a mount in chloral hydrate solution, a bright purplish color, while the fragments of cork from Rhamnus Purshiana remain of a brown or reddish-brown color.

RHAMNUS CATHARTICUS BARK.

(The material used for this study was obtained from cultivated plants from the Missouri Botanical Gardens of St. Louis, from the south parks of Chicago, and from plants in the author's garden in Oak Park, Ill.)

The stem of *Rhamnus catharticus* does not often possess a terminal bud. After the growth for the summer has ceased the terminal bud usually dies and that portion of the stem, 5 to 40 mm. long, projecting beyond the uppermost pair of axillary buds, hardens and becomes more or less pointed and thorny.

In transverse sections from about the middle of the lateral bud the epidermis corresponds to the similar epidermis of *Rhamnus purshiana* except that it is almost devoid of trichomes. A few appressed pairs are noted on the bud scales. The parenchyma of the middle bark consists of rounded cells up to 30 microns in diameter with thin, cellulose walls, cytoplasm, nucleus, chloroplasts and an occasional rosette aggregate of calcium oxalate. No mucilage sacs are present. Evidences of a primary bast are seen. Neither medullary rays nor cambium are present. The pith cells contain many large rosettes of calcium oxalate, but no mucilage sacs are present. Total diameter 1 mm.: cortex 175 microns wide, wood circle 125 microns wide, pith 400 microns in diameter.

In sections from the base of the bud the structure of the stem is very similar to that just described, except that the wood circle is wider, up to 200 microns, the xylem masses contain 10 or 12 tracheal tubes in a radial row and medullary rays are distinct.

The stem just below the uppermost pair of lateral buds has already attained a considerable maturity, as is evidenced by a growth of cork, of secondary bast, phloem and medullary rays and a lignification of the pith. The following is a brief description of sections 1 mm. below the base of the uppermost pair of lateral buds.

Epidermis—cells 15 microns radially, 20 microns tangentially, cuticle 8 to 10 microns thick. Cork—8 to 10 tangential rows of cells have a total width of 30 microns radially, the cells being 15 to 75 microns tangentially, the lumen but a

line and the walls thin and brown. Outer parenchyma—slightly collenchyma-like, the cells 15 microns radially, 15 to 30 microns tangentially. Inner parenchyma—isodiametric, up to 30 microns in diameter the cell contents brownish in color. Primary bast—in masses much elongated tangentially, 2 or 3 cells wide radially, the cells seldom exceeding 15 microns in diameter, somewhat compressed, with very thick cellulose walls. Secondary bast—1 or more rows of small bundles containing 3 or 4 to 15 or 20 cells tangentially and 1 to 3 cells radially, the fibers seldom exceeding 12 microns in diameter, with thick lignified walls. Crystal fibers—abundant; in structure and location the same as in *Rhamnus purshiana*. Medullary rays—distinct, 1, 2 or 3 cells wide. Phloem—parenchyma abundant; sieve and companion cells in small patches, the sieve plates difficult to differentiate. Wood circle—300 microns thick.

A transverse section at the base of the season's growth, measuring 2.3 mm. across, corresponds very closely to the above description, except that the wood ring is 400 microns in thickness.

The bark from a stem four years old measured 0.7 mm. in thickness. The structure of this bark differs but little from that described above, though the following changes may be noted: Cork—somewhat thicker and occasionally roughly split longitudinally. Primary bast—in small bundles rather widely separated by parenchyma. Secondary bast—in 3 irregular tangential rows. The prismatic crystals of the crystal fibers are very prominent. Rosette aggregates 10 microns across are common in the phloem.

Bark that would correspond with commercial bark if the drug was on the market may be described as follows: A specimen 2 mm. thick possessed a dense cork layer from 100 to 300 microns thick, dark yellow-brown in color and much fissured and flaked. The middle bark, 200 microns thick, consisted mostly of chlorophyll-bearing parenchyma, a few of the outer rows somewhat collenchymatous, with a few rosettes, a few widely separated primary bast strands and no stone cells. The inner bark 1620 microns wide at the thickest part, had 18 tangential rows of secondary bast, the character of each bast strand typically that of

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(Detail of cuts on succeeding page.)

RHAMNUS CHLOROPHORUS, CAROLINIANA, CROCEUS, AND CALIFORNICA.

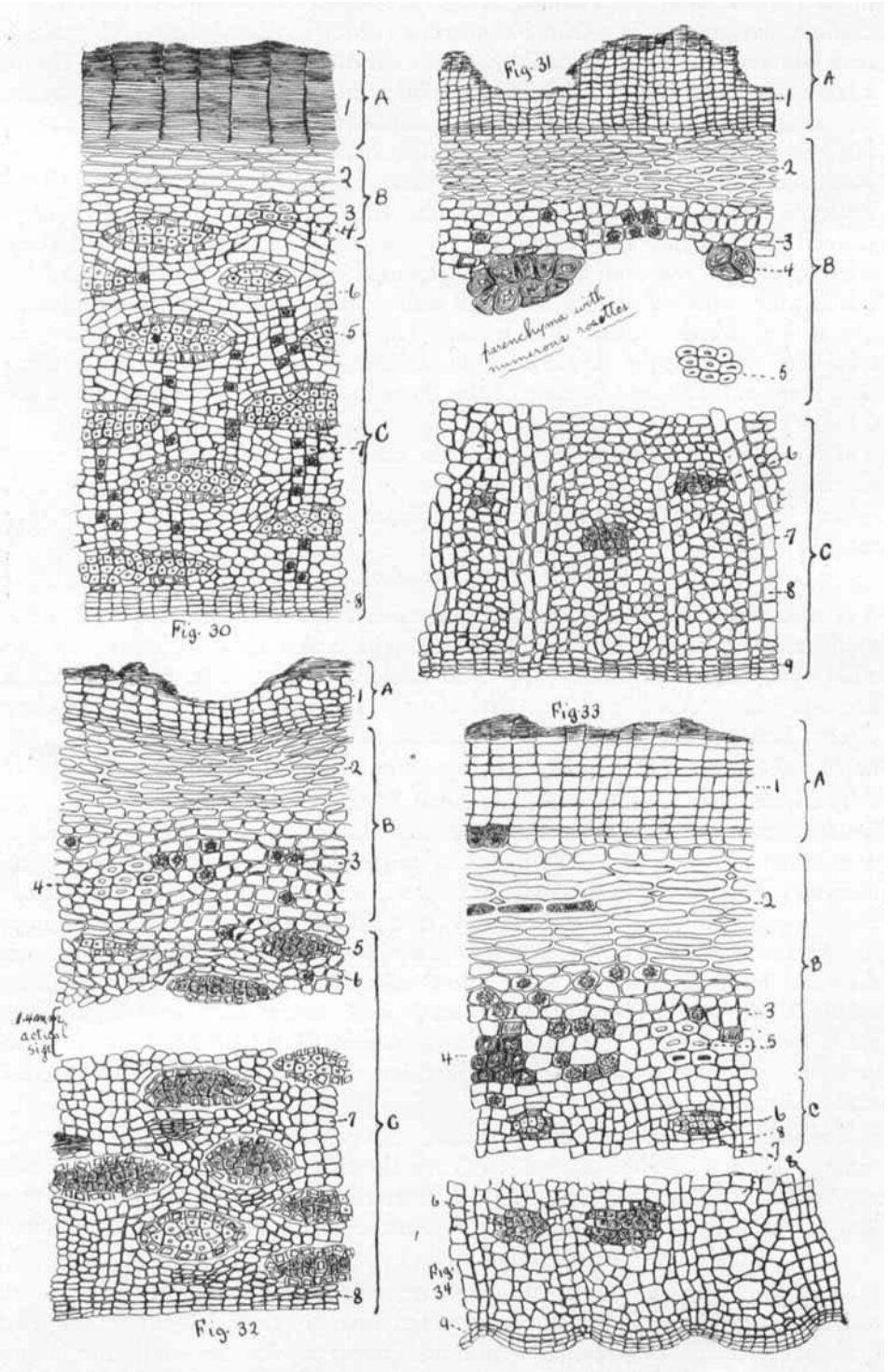
Fig. 30—Transverse section of mature bark from *Rhamnus chlorophorus*. A—outer bark, B—middle bark, C—inner bark. 1—cork, the cells narrowed radially and elongated tangentially and the outermost rows compressed; 2—collenchyma; 3—parenchyma; 4—unlignified primary bast; 5—lignified secondary bast with accompanying crystal fibers; 6—phloem, consisting mostly of parenchyma and bearing no crystals; 7—medullary ray with numerous rosette aggregates of calcium oxalate; 8—cambium. (X 200, reduced ½.)

Fig. 31—Transverse section of the bark from a 5-year-old stem of *Rhamnus caroliniana*. A—outer bark, B—middle bark, C—inner bark. 1—cork, the outermost rows compressed; 2—collenchyma, strongly differentiated and with thickened cellulose walls; 3—parenchyma with rosettes and prisms of calcium oxalate; 4—masses of stone cells; 5—unlignified primary bast; 6—lignified secondary bast with crystal fibers; 7—phloem, consisting mostly of parenchyma and bearing small rosettes; 8—medullary ray without crystals; 9—cambium. (X 200, reduced ½.)

Fig. 32—Transverse section of the mature bark of *Rhamnus croceus*. A—outer bark, B—middle bark, C—inner bark. 1—cork, the outermost rows compressed; 2—collenchyma, tangentially elongated cells with thickened cellulose walls; 3—parenchyma with large rosettes of calcium oxalate crystals; 4—unlignified primary bast; 5—lignified secondary bast with crystal fibers, the bundles mostly separated from the surrounding parenchyma; 6—phloem, the cells sometimes compressed and consisting mostly of parenchyma with occasional rosettes of calcium oxalate; 7—medullary ray without crystals; 8—cambium. (X 200, reduced ½.)

Fig. 33—Transverse section of the bark from a 10-year-old stem of *Rhamnus californica*. A—outer bark, B—middle bark, C—inner bark. 1—cork, the outermost rows compressed; 2—collenchyma, strongly elongated tangentially with much thickened walls; 3—parenchyma with numerous rosettes and prisms of calcium oxalate; 4—a group of stone-cells; 5—unlignified primary bast; 6—lignified secondary bast with crystal fibers; 7—phloem parenchyma; 8—medullary ray. (X 200, reduced ½.)

Fig. 34—Transverse section of the inner bark of *Rhamnus californica* stem. 6, 7 and 8—same as in Fig. 33. 9—the cambium, the edge showing the waviness characteristic of this bark. (X 200, reduced ½.)


A
B
C
1
2
3
4
5
6
7
8
Fig. 30
Fig. 31
parenchyma with numerous raphides
Fig. 32
Fig. 33
Fig. 34

the bast in Rhamnus Purshiana, though the bundles in *Rhamnus catharticus* are smaller, being mostly less than 200 microns (about 12 fibers) tangentially and less than 60 microns (4 fibers) radially, most of them but 2 fibers radially. The bast strands are inclined to unite with one another in each row and even form extensive tangential layers penetrated by the medullary rays. The phloem masses are distinct, though the sieve plates are differentiated with difficulty, most of the phloem cells being parenchyma, somewhat elongated longitudinally and with strongly beaded walls. Many cells with yellow contents are scattered in the phloem parenchyma and practically all the cells of medullary ray and phloem acquire a bright red color with potassa solution. The medullary rays are seldom 3 cells wide, mostly 2 cells or but 1 cell wide. The cells are elongated tangentially (up to 45 microns) rather than radially (up to 20 microns). In the tangential section of the bark, the rays are broadly elliptic because of this tangential elongation of the ray cells and because of the shortness of the rays longitudinally, about 6 to 10 cells.

It is to be noted that the bast strands easily separate from the surrounding parenchyma and in longitudinal section or in the powder the interlacing bundles appear in long masses with numerous fusiform spaces through which have passed medullary rays.

RHAMNUS CROCEUS BARK.

A specimen of bark 2.5 mm. thick possessed a rather thin cork layer, about 100 to 200 microns thick, rough and flaked and with cork cells nearly square or somewhat elongated tangentially (15 to 30 microns long). The middle bark (320 microns wide) consisted of an collenchymatous portion and an inner parenchyma layer. Rosettes and prisms of calcium oxalate were very abundant. There were no stone cells, but a few widely-separated strands of non-lignified primary bast.

The inner bark, 2 mm. wide, contained 18 tangential rows of secondary bast bundles, each strand like that of Rhamnus Purshiana bark. The bast bundles were from 8 to 30 cells (350 microns) tangentially and from 1 to 5 cells (80 microns) radially. The crystal fibers were very abundant, sometimes 2 rows about a bast bundle. The medullary rays, in tangential view, were elliptical, though not so broad as in *Rhamnus catharticus*, from 6 to 12 cells (100 to 250 microns) longitudinally and from 1 to 3 cells (20 to 80 microns) wide, though mostly 2 cells wide. The cells were nearly isodiametric, sometimes slightly elongated tangentially or radially, and nearly devoid of rosette crystals. In transverse view the rays were rather indistinct, but could be followed. There were 30 rays in 6 mm. of bark.

The phloem consisted mostly of parenchyma cells elongated longitudinally with square ends and non-beaded walls. Often the cells were much compressed radially between the bast bundles. Crystals were rather few except in the outer portion of the inner bark. All the parenchyma cells of the inner bark acquired a bright red color with potassa solution.

As in *Rhamnus catharticus* bark the bast strands easily separate from the surrounding parenchyma. In transverse section many of them fall out, leaving elliptical spaces and in longitudinal section and in the powder the interlacing bundles are in long masses with elliptical spaces through which passed medullary rays.

RHAMNUS CHLOROPHORUS BARK.

The dried bark from old stems soaked in dilute alcohol and sectioned, exhibited the following structure:—

Outer bark—100 to 300 microns thick, consisting of a brown cork layer supporting externally some thin lichen growths and internally a narrow disrupted phellogen. The cork cells are much elongated tangentially up to 75 microns, narrow radially, 8 to 10 microns, thin-walled, suberized.

Middle bark—200 microns thick, consists mostly of tangentially elongated collenchyma cells, up to 100 microns, but not more than 15 microns radially, with thick cellulose walls and long narrow cavities with brownish, granular contents. An occasional strand of much compressed unlignified primary bast is seen. No stone cells are present. Some rosette aggregates of calcium oxalate.

Inner bark—up to 1 mm. thick. Contains very many bundles of strongly lignified secondary bast separated by interlacing bands of phloem and indistinct medullary rays. There were 12 tangential rows of bast bundles in an inner bark 0.9 mm. thick.

The bast bundles are elliptic in transverse view, 2 to 5 cells wide radially and 5 to 20 cells tangentially, the fibers not more than 15 microns thick and each bundle invested by a single row of crystal fibers, typically those described under Rhamnus Purshiana. The phloem does not display sieve tubes well, but apparently consists mostly of parenchyma, the cells of which are rounded or oval, somewhat compressed tangentially and elongated longitudinally. Because of the number and close proximity of the bast strands and the indistinctness of the medullary rays, the narrow bands of phloem appear as though interweaving around and between the bast strands. The medullary rays are very indistinct in the transverse view, though they can be traced by a very slight difference in the shape of their cells from the surrounding parenchyma cells and by the presence of calcium oxalate rosettes. These crystals are numerous in the rays, but very scarce in the other tissues of the inner bark. In the tangentjal section the rays are elliptic in shape, 2, 3 or 4 cells wide at the broadest part, 10 to 30 cells long. They penetrate the bast strands and phloem parenchyma.

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FRESHLY PRECIPITATED RESINS IN AQUEOUS MEDIUM.

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The object of this paper is to serve the two-fold purpose of suggestion to some future investigator, and to present a practical application of an observed phenomenon.

It is prompted by the reading of a query sent to the editor of one of our leading trade journals, which appears in the current issue of December, just received. The correspondent asks for information concerning the method to be employed in the preparation of a mixture of rose-water, glycerin and tincture of benzoin, a well-known and popular form of toilet cream.

Ten years ago, or more, the writer observed that the various resinous tinctures of the United States Pharmacopœia, such as the tinctures of benzoin, myrrh, asafetida, etc., were differently affected by the same volume of water; the permanence of suspension of the freshly-precipitated resin, depending upon the method employed in bringing these two substances together. The two following experiments were performed at that time.

Experiment No. 1:—Three ounces of distilled water were introduced into a four-ounce prescription bottle, and one half fluid-dram of tincture of benzoin was then carefully added, drop by drop, shaking the contents of the bottle vigorously after the addition of each drop.

Suspension of the precipitated resin, was apparently complete, until the addition