STUDIES OF THE BARK OF MYRICA CERIFERA, LINNÉ.*

BY HEBER W. YOUNGKEN.

During the years 1912 to 1915 the author of this paper carried on an investigation of the structure, classification and distribution of the species of the *Myricaceæ* that are indigenous to the Eastern United States. The results of this work have been published in "Contributions from the Botanical Laboratory of the University of Pennsylvania."[1] In this report, while the microscopical as well as the gross anatomical features of the various organs of several *Myrica* species including *M. cerifera* were among the points discussed, no attempt was made to emphasize the bark of *M. cerifera* any more than any other region of this or the other species considered, the dissertation being of pure botanical character and intent. Since that time a goodly number of samples labeled "Bayberry Bark" have come under his observation. The majority of those examined up until about a year ago represented varying proportions of root and rhizome bark or root, rhizome and aerial stem bark, while one sample consisted entirely of aerial stem bark. Three samples of bark examined the last year and coming from different commercial houses were found to consist entirely of root bark and root of *Myrica cerifera*. Thus from a pure botanical problem interest began to develop in a pharmacognic one.

In the National Formulary IV, Myrica Bark is listed under the title of Myrica[2] with the synonym of "Bayberry Bark."

It is here defined as follows: "The dried bark of the root of *Myrica cerifera* Linné (Fam. *Myricaceæ*) without the presence of more than 5 per cent. of adhering wood." It appears to be official mainly on account of its being employed as one of the ingredients of Pulvis Myricæ Compositus (Compound Powder of Bayberry), N. F.

On account of his familiarity with the general content of specimens of this bark coming from the states bordering the South Atlantic seaboard, the writer began to wonder why the rhizome and aerial stem bark were not recognized along with the root bark, especially since the roots of so many of these plants which he had previously investigated were so thin and yielded comparatively little bark as compared with the longer and thicker rhizomes and aerial stems. It was this thought which led to the more minute study of the bark portion of the plant from a pharmacognic standpoint. Samples of root, aerial stem and rhizome barks of *Myrica cerifera* were collected by the writer from plants growing in a brackish swamp near Petersburg, N. J. These were later studied from the physical, microscopical and qualitative chemical viewpoints, the materials used being in part fresh, dried and powdered. The standard specimens were later compared with several samples of the article of commerce and previous conclusions verified.

Seeing that a number of physical characteristics are common to root, aerial stem and rhizome barks of a wide range of authentic specimens, these will be first described collectively.

PHYSICAL CHARACTERISTICS OF MYRICA CERIFERA BARK.

In transversely curved pieces, strips or quills of varying length and breadth and usually 2.5 mm. or less in thickness, rarely up to 5 mm. thick (aerial stem

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bark); outer surface varying from silvery gray to grayish brown or reddish brown, scaly in rhizome and root barks, bearing occasional warts or slight transverse ridges, that of the aerial stem bark exhibiting a number of raised oval lenticels; inner surface reddish brown to brown, finely longitudinally striated, somewhat roughened (rhizome and root barks); fracture short, weak and uneven, the fractured surface reddish brown with short projecting fibers near and along inner margin of root bark; odor characteristic; taste astringent, mildly bitter and slightly acrid.

HISTOLOGY OF ROOT BARK OF MYRICA CERIFERA.

Sections of the root bark (Fig. 1), when examined microscopically, exhibit an outer cork of several layers of suberous cells many of which possess lignified

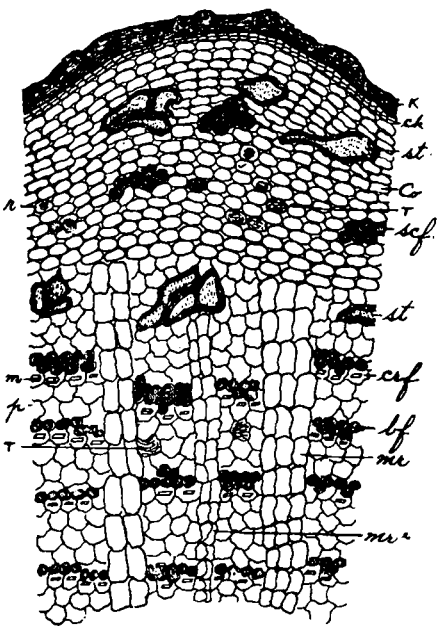

Fig. 1.—Transverse section of root bark of *Myrica cerifera* L.—showing cork (*K*); cork cambium (*ck*); cortex (*Co*); tannin cells (*T*); stone cells (*st*); sclerenchyma fibers (*scf*); rosette crystals of calcium oxalate (*r*); monoclinic prisms of calcium oxalate (*m*); phloem (*p*); bast fibers (*bf*); primary medullary-ray (*mr*); secondary medullary ray (*mr*²); and crystal fibers (*crf*). × 75.

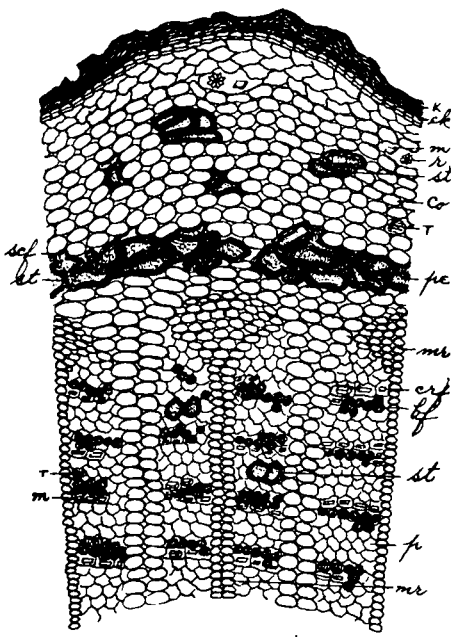

Fig. 2.—Transverse section of aerial stem bark of *Myrica cerifera* L.—showing cork (*K*); cork cambium (*ck*); cortex (*Co*); pericycle (*pe*), containing a nearly continuous band of sclerenchyma fibers (*scf*), and stone cells (*st*), the latter predominating; phloem (*p*); bast fibers (*bf*); crystal fibers (*crf*); tannin cells (*T*); medullary rays (*mr*); rosette crystals (*r*); and monoclinic prisms of calcium oxalate (*m*). × 75.

walls, a phellogen of meristematic cells, a secondary cortex of cortical parenchyma, some of the cells of which contain tannin, others starch, others rosette crystals or monoclinic prisms of calcium oxalate, while some are more or less filled with a yellowish brown substance termed by Tison and Chevalier[4] "lignine gommeuse," a broad phloem separated into a number of phloem patches by starch-containing medullary-rays which frequently broaden out toward the cortex. The primary medullary-rays are mostly 1 to 4 cells, rarely 1 to 5 cells broad. The secondary medullary-rays are 1 to 2 cells broad. Scattered among the cells of both phloem and cortex will

be noted numerous sclerenchyma fibers and stone cells arranged both singly and in groups. The former are often accompanied by crystal fibers containing monoclinic prisms of calcium oxalate. The stone cells are of variable shape, have lamellated, porous walls and vary in length from 24 microns to 129 microns and in breadth from 15 to 59 microns. The monoclinic prisms vary in length from 7 to 22 microns, while the rosette aggregates are from 11 to 35 microns in diameter. The starch grains are single or 2–4 compound, the individual grains spheroidal or plano-convex and up to 12 microns in diameter.

HISTOLOGY OF AERIAL STEM BARK OF MYRICA CERIFERA.

Sections of the aerial stem bark (Fig. 2) have a somewhat similar appearance to those of the root bark, being chiefly distinguished from the latter by possessing a continuous or nearly continuous band of sclerenchyma fibers and cells in the pericycle. The outer three or four layers of exocortex tend to be collenchymatic and show no distinct air spaces. The primary medullary-rays, moreover, are usually one to three rows of cells in width.

HISTOLOGY OF RHIZOME BARK OF MYRICA CERIFERA.

Sections of the rhizome bark (Fig. 3) differ from those of the root or aerial stem barks mainly by the absence of sclerenchyma elements in the cortex, by the presence of fewer sclerenchyma elements in the phloem and further by the presence of a discontinuous zone of widely separated islets of narrow, comparatively thin-walled sclerenchyma fibers in the pericycle. All three barks possess abundant tannin cells in cortex and phloem.

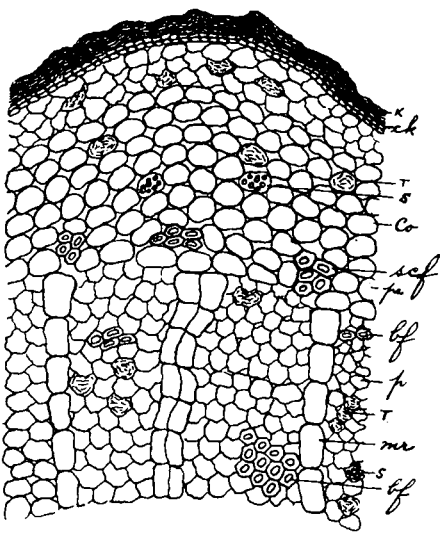

Fig. 3.—Transverse section of rhizome bark of *Myrica cerifera* L.—showing cork (*K*); cork cambium (*ck*); cortex (*Co*); pericycle (*pe*), containing islets of sclerenchyma fibers (*scf*); phloem (*p*), separated into phloem patches by medullary-rays (*mr*); bast fibers (*bf*) in phloem patches; starch (*s*), and tannin (*T*). × 75.

Powdered Myrica cerifera Bark (consisting of a mixture of equal parts of root, aerial stem and rhizome barks).

The powdered drug is reddish brown. When examined microscopically it exhibits numerous simple or two- to three- or rarely four-compound starch grains, the individual grains being spheroidal or plano-convex, often with a central cleft and up to 12 microns in diameter; calcium oxalate crystals chiefly in monoclinic prisms from 7 to 22 microns in length, some in the form of rosette aggregates from 11 to 35 microns in diameter; numerous strongly lignified sclerenchyma fibers with walls up to about 13 microns in thickness; numerous stone cells of varying shape and up to 125 microns in length, with thick, lignified, lamellated and porous walls; cork cells polygonal in surface view and frequently with lignified walls; numerous fragments of parenchyma some of the cells of which are rich in starch, others tannin, others containing gummy lignin which is insoluble in cold or boiling

water, cold concentrated potash solution, ammonia, alcohol or xylol but soluble in boiling nitric acid, boiling concentrated potash solution and hot solution of sodium hypochlorite; tracheæ from adhering wood few or absent.

CHEMISTRY OF BARKS OF MYRICA CERIFERA.

The chemistry of the root bark of *M. cerifera* has been investigated by Hambright[3] who found it to contain the following substances: albumen, tannic acid, gallic acid, starch, gum, red coloring matter, extractive, an acrid resin soluble in alcohol and ether, an astringent resin soluble in alcohol and insoluble in ether, myricinic acid, ligneous fiber, salts of potassa, salts of lime, protoxide of iron, magnesia and silicic acid. Chevalier[4] later reported a substance in certain cells of the root and stem of *Myrica cerifera* and other species which is insoluble in cold or boiling water, cold concentrated potash solution, ammonia, alcohol or xylol, but soluble in boiling nitric acid, boiling concentrated potash solution and hot solution of sodium hypochlorite. To this substance they assigned the name of "lignine gommeuse" (gummy lignin). The writer has not as yet found opportunity to conduct more than a few qualitative chemical tests on the material at hand. He is, however, able to report having found a tannin which gives a bluish black precipitate with ferric chloride T. S. in each of the three barks studied. In addition for each of the barks, he has also determined the presence of gallic acid, red coloring matter, starch and gummy lignin (lignine gommeuse).

Examination of three specimens of powdered bark showed an average of 3.05 per cent. of total ash.

PROPERTIES AND USES OF MYRICA BARK.

H. C. Wood[5] ascribes to the root bark moderate tonic and astringent properties. It is reported to have been used by various sects of medical men during the past century in the form of infusion, decoction and fluidextract for dropsical affections succeeding intermittents, in uterine hemorrhage, in dysentery, as a gargle in inflammation of the throat and as an astringent in sluggish circulation of the skin. The powdered bark has been applied as a stimulant to indolent ulcers. The astringent and tonic effects ascribed to it are undoubtedly due to the presence of tannin and gallic acid which has been determined by Hambright[3] for the root bark and by the writer for the aerial stem and rhizome barks. Each of the barks have a close similarity in odor and taste and are astringent in action.

SYNONOMY.

A long list of common names has been assigned to *Myrica cerifera* in the past. Among these were the following: Wax Myrtle, Bayberry, Candleberry, Wax Berry, Candelwood, Candle Tree, Tallow-shrub, Sweet Oak and Tallow-bayberry. Fernald and Robinson,[6] Britton and Brown[7] and other leading systematists, however, recognize and list most conspicuously the synonym for *Myrica cerifera* L. as Wax Myrtle and that for a closely related deciduous species, *Myrica Carolinensis Mill.*, as Bayberry.

SUMMARY AND CONCLUSIONS.

1. The majority of commercial specimens labeled "Bayberry Bark" examined by the author have been found admixed with rhizome and aerial stem bark or of rhizome bark only of *Myrica cerifera* L.

2. The physical characteristics of the root, rhizome and aerial stem barks of *Myrica cerifera* have been studied and collectively described.

3. Histological studies have been made on the authentic bark of roots, rhizome and aerial stem of *Myrica cerifera*, all of which were found to contain abundant tannin cells.

4. A number of commercial samples of "Bayberry" (Myrica) bark obtained during a period of five years were examined and compared with authentic materials collected by the author near Petersburg, New Jersey, the results observed agreeing with his previous conclusions.

5. The most important diagnostic difference between the three barks studied are given. It is shown that the root bark is devoid of a pericycle containing sclerenchyma fibers and stone cells, whereas the stem bark possesses a continuous or nearly continuous band of sclerenchyma fibers and stone cells in the pericycle and the rhizome bark a discontinuous zone of widely separated islets of narrow, comparatively thin-walled sclerenchyma fibers in this region.

6. The powdered bark of *Myrica cerifera* has been studied physically and histologically and its peculiarities described.

7. The writer has verified Hambright's observations so far as the presence of tannin, gallic acid, starch and red coloring matter in *M. cerifera* root bark are concerned and in addition has determined the presence of these constituents alike in the rhizomes and aerial stem barks of the same species.

8. Verification has also been made of the presence of lignine gommeuse in certain cells of the cortex and phloem of all three barks, as observed first by Tison and Chevalier.

9. Since leading systematists of the present day recognize Bayberry as the most common synonym for *Myrica Carolinensis* and Wax Myrtle as the most frequently employed one for *Myrica cerifera*, it seems advisable, in order to avoid confusion, to recommend that the present synonym appearing under Myrica in the National Formulary IV be changed in the present revision to Wax Myrtle or Wax Myrtle Bark.

10. Since all three barks of *Myrica cerifera* contain abundant tannin and gallic acid to which their astringent properties are due and since astringency seems to be the main dynamic property of Myrica bark and since the crude drug of commerce is frequently a mixture of root and rhizome barks or root, rhizome and aerial stem barks of *M. cerifera*, the author recommends that all of the bark of this plant be recognized in the next edition of the National Formulary, provided quantitative determination of the tannin in the three barks confirms the microscopic findings.

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