

Section on Scientific Papers

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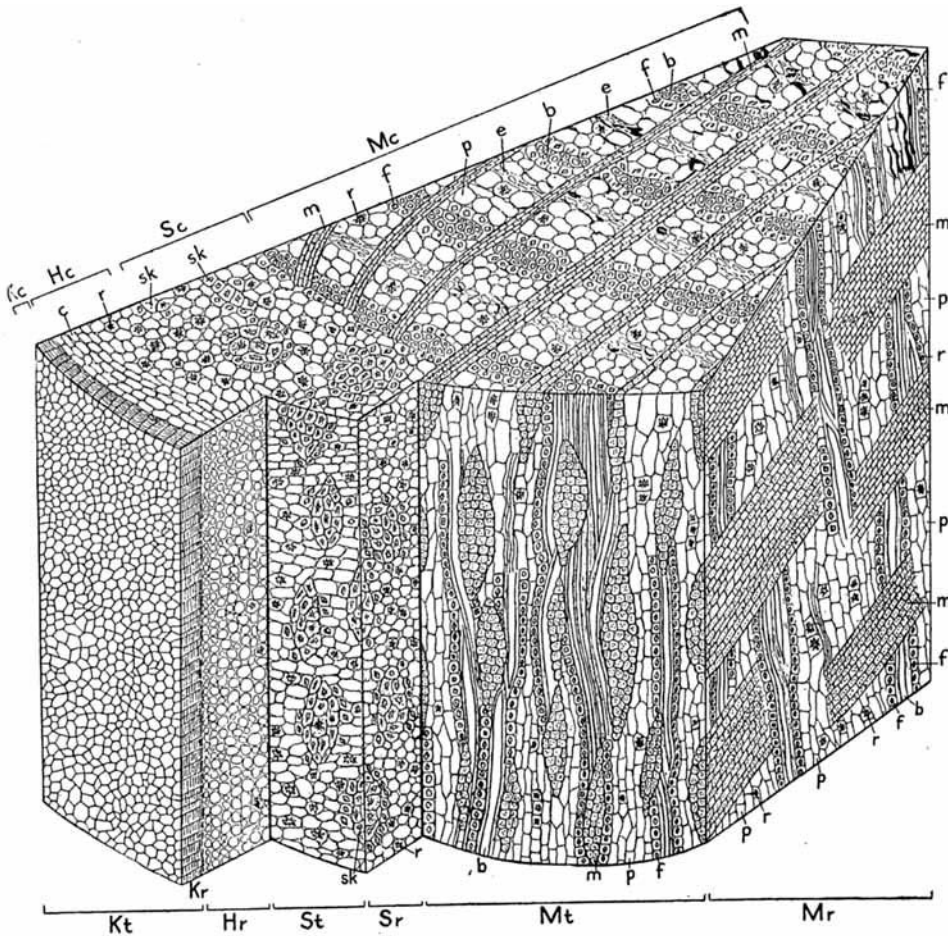
THE MEDULLARY RAY CELLS IN RHAMNUS PURSHIANUS.

HENRY KRAEMER, PH. D.

Pharmacognocists have been under the impression for some years that in the study of the medullary ray cells of more or less closely related drugs characters may be found that are useful in distinguishing between them. As a typical illustration of this point it has been stated that the medullary rays in Jamaica Quassia are from two to five cells wide while in Surinam Quassia they are one or two cells wide. As a matter of fact I have examined specimens of supposed Surinam Quassia, which were probably authentic in that they showed the absence of crystals, yet the number of cells in the width of the medullary rays closely agreed with that of Jamaica Quassia. Again, it is usual to attempt to differentiate between the barks of Rhamnus Purshianus and Rhamnus Californicus by reason of the apparent difference in the number of cells comprising the width of the medullary rays. I have been inclined to the view and have so expressed myself that the medullary ray cells in Rhamnus Purshianus are usually one or two cells wide whereas in Rhamnus Californicus they are three to five cells wide.¹ On account of the difficulty of procuring authentic specimens of R. Californicus I will not discuss at this time whether there is any actual difference in the number of cells of the medullary rays in these two barks. There is, however, considerable misapprehension on the part of different authorities in regard to the number of cells comprising the width of the medullary rays in R. Purshianus. For instance, Moeller² says that the medullary ray cells of R. Purshianus are from four to five cells wide, whereas in R. Frangula they are two to three cells wide. As a matter of fact these two barks are readily distinguished in powder or in section, by the absence of stone cells in R. Frangula. Vogl³ in his commentary on the eighth edition of the Austrian Pharmacopoeia, says that the medullary ray cells in R. Purshianus are from two to five cells wide, being mostly three cells wide. Karsten and Oltmann⁴ in their Lehrbuch say, that the medullary ray cells in R. Purshianus are mostly three cells wide, but may occur as many as five cells in width, thus differing materially from R. Frangula. In the German Pharmacopoeia it is stated that the light yellow medullary rays of R. Purshianus are usually three to five cells wide, and seldom one or two. The Pharmacopoeia Helvetica states that the medullary ray cells of R. Purshianus are one to five cells wide.

The reason for these varying statements is probably due to the fact that most of the studies of crude drugs have been carried on with transverse sections. Owing to the interest in the study of powdered drugs in recent years, crude drugs are being examined in longitudinal section, but generally these sections are made

more or less haphazard and are probably mostly of a radial-longitudinal nature. Every student knows that in the study of cells and in the arrangement of tissues three views of them are necessary for a complete understanding of them, and these are obtained by making transverse, radial-longitudinal, and tangential-longitudinal sections. Ordinarily it may not be a matter of great moment as to what kind of longitudinal sections are made. But if a clear idea of the width as well as



The outer bark and part of the inner bark of *Rhamnus Purshianus* in transverse, radial-longitudinal, and tangential-longitudinal sections. **Mc**, transverse section of inner bark; **Mt**, tangential-longitudinal section of inner bark; **Mr**, radial-longitudinal section of inner bark; **St**, transverse section of stone cell area; **St**, tangential-longitudinal section of stone cell area; **Sr**, radial-longitudinal section of stone cell area; **Mc**, transverse section of outer layers, of cortex; **Mr**, radial-longitudinal section of outer layers of cortex; **Mc**, **Mt**, **Mr**, transverse, tangential-longitudinal, and radial-longitudinal sections of cork. **b**, bast fibers; **f**, crystal fibers; **p**, parenchyma; **l**, sieve; **sk**, stone cells; **m**, medullary ray cells; **c**, collenchyma.

height of the number of cells comprising the medullary rays is to be ascertained it is absolutely necessary to examine tangential-longitudinal sections, in fact sections of this character are alone necessary, particularly when made of the tissues in the vicinity of the cambium. In this view the medullary ray cells occur in more or less bi-convex groups of a limited number of cells, extending more or less scattered throughout the tissues of the collateral and bicollateral fibro-vascular

bundles. It should be emphasized that these sections must be made in the area lying between the pith on the inside and the primary cortex on the outside. That is, in the bark, the sections must be made in the inner bark, because the medullary ray cells of the bark are included only in the phloem and this area does not usually extend throughout the width of the bark.

Coming to the drug which has been studied in order to illustrate this paper, it will be seen from an examination of the several sections, namely transverse, radial-longitudinal, and tangential-longitudinal, why there are these discrepancies throughout the literature in regard to the number of cells comprising the width of the medullary rays. This is especially brought out if these views are connected in a single drawing such as illustrates this paper. This illustration brings out clearly the relative position and arrangement of the tissues in the bark and one sees how in the different sections different views are presented, none of which has a meaning without the others. The following points are to be observed:

1. That the medullary ray cells occur only within the tissues of the inner bark, that is, in those inside of the primary cortex.
2. That, in the transverse section the medullary rays appear as somewhat straight or curved lines, one to four cells in width.
3. That, in tangential-longitudinal section these occur in more or less biconvex groups. At both ends of these groups we usually find a single cell. As the convex area widens we find two cells side by side and then near the middle it may be three or four cells in width. I do not recall having seen as many as five cells side by side in the middle of these bi-convex groups. Some of the narrowed bi-convex areas may not be more than two cells in width.
4. That, in comparing the tangential-longitudinal section with the transverse section, the variation in the width of the rays becomes at once intelligible.
5. That, where the rays are one cell wide in transverse section either a very narrow bi-convex group has been cut across or the section has been made across the end of a broad group.
6. That, when the ray in transverse section is three or four cells wide, the section has been made through the middle of a broad bi-convex group.
7. That, in the radial-longitudinal section the medullary rays appear as a series of parallel lines, the number of cells in height depending on what part of the rays have been cut, and only if the section is made vertically through the middle of a group do we observe the maximum number of cells. The radial-longitudinal section, therefore, does not provide any additional information.

Probably sufficient has been said, in addition to the illustration here presented, to show the importance of the examination of tangential sections when studying medullary rays. This is important not only when attempting to find differences in closely related species of commercial varieties of drugs, but it is absolutely necessary in describing accurately the tissue which lies between the collateral and bicollateral bundles. When studies of this kind are made as, for instance, in the rhizome of *cimicifuga* it is almost immediately observed that the cells between the collateral bundles are not of the type of medullary rays, and again in the study of drugs like cinnamon and cinchona where in transverse section, in some cases at least, the medullary ray cells are more or less indistinct, they are almost immediately determined when tangential sections are made.

The medullary rays are of such a definite character in that they occur in more or less bi-convex groups when seen in tangential view that only a very few tangential-longitudinal sections are necessary to bring out the number of cells which make up their width or height.

In conclusion one other observation of interest may be mentioned and that is that the medullary ray cells near the cambium have a tangential diameter usually

much narrower compared with those found in the region near the cortex. For instance, the width of a medullary ray cell near the cambium will be about 0.010 mm., while the width of the cell in the same ray near the cortex will be 0.020 mm.

REFERENCES TO LITERATURE.

1. A Text-Book of Botany and Pharmacognosy. Fourth Edition. By Henry Kraemer. P. 524.
2. J. Moeller. *Pharm. Post*, 1890 (23), p. 237.
3. Kommentar zur achten Ausgabe der Osterreichischen Pharmakopoe. By August v. Vogl. 2te Band. 1908. P. 282.
4. Lehrbuch der Pharmakognosie, by George Karsten and Friedrich Oltmans. 2te Auflage. 1909. P. 133.

THE CRYSTALLINE ALKALOID OF CALYCANTHUS GLAUCUS.

(Fourth Paper.)

SOME SALTS OF A NEW QUATERNARY BASE OBTAINED BY METHYLATION OF ISOCALYCANTHINE.

H. M. GORDIN.

It was shown in the last paper on this subject¹ that anhydrous isocalycanthine has the formula $C_{11}H_{14}N_2$, and that when recrystallized from a mixture of acetone and water it contains some water of crystallization the exact amount of which is difficult to determine, owing to the extreme slowness with which this water is given off. When the alkaloid is kept in vacuo over sulphuric acid, the loss of the water of crystallization is at first quite fast, but very soon slackens down to such an extent that it can be observed only when working with considerable quantities and weighing every month or two. I have now been keeping 1.9862 gm. of the alkaloid in vacuo over sulphuric acid for about twenty months. So far the loss amounts to 0.0894 gm. and the weight has not changed within the last two months. Supposing there will be no further loss, the amount of water of crystallization found would be 4.5 per cent, corresponding to half a molecule H_2O .

Calculated for $C_{11}H_{14}N_2 \cdot \frac{1}{2}H_2O$, 4.92 per cent. H_2O .

It was also shown in that paper that besides a CH_3N group, isocalycanthine contains an NH group, since when treated with nitrous acid, it given an insoluble nitrosamine. It was therefore expected that it would react with one molecule of methyl iodide to form a tertiary methylisocalycanthine of the formula $C_{11}H_{13}(CH_3)N_2$, and with two molecules of methyl iodide to form a neutral quaternary methiodide of the formula $C_{11}H_{13}(CH_3)N_2 \cdot CH_3I$. A large number of experiments showed, however, that whether the methyl iodide is in excess or the alkaloid is in excess, whether the reaction takes place in the cold or at 100° under pressure, in no case is either of the expected substances formed. Under all conditions so far tried the reaction products are as follows: About 35 per cent of the isocalycanthine taken takes no part in the reaction, and can be recovered unchanged; about 35 per cent of the isocalycanthine is converted into its hydriodide, while the rest is transformed into a new quaternary iodide having the entirely unexpected formula

¹J. Am. Chem. Soc., 31, 1305.