

# New York Agricultural Experiment Station.

PETER COLLIER, DIRECTOR.

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BLACK KNOT OF PLUM AND CHERRY.

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GENEVA, N. Y.

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\*Connected with Fertilizer Control.

## BLACK KNOT OF PLUM AND CHERRY.

*Plowrightia Morbosa*, (Schw.) Sacc.

The "Black Knot" is a disease of plums and cherries which causes the formation of a hard, rough, black, wart-like surface on an enlarged or distorted outgrowth of the bark. It is not a new disease. Its pernicious character has long been known. Nearly fifty years ago Mr. A. J. Downing said of it\* that "in some parts of the country it is a most troublesome disease and has even destroyed the whole race of plum trees in neighborhoods where it has been suffered to take its course." Could he have looked into the future and seen the plum industry literally wiped out of existence by Black Knot not only "in whole neighborhoods" but in whole counties along the famous Hudson River valley, doubtless the strong words quoted above would have seemed to him a faint statement of the destructive character of this disease. Although Downing did not know the real cause of the trouble yet he urged upon his readers the proper remedy, namely, the destruction of all affected parts by fire; but he advocated burning as early as possible in the spring, while, as will be shown hereafter, the proper time is just after the leaves fall. He also gave the following sound advice: "It will be necessary to prevail on your neighbors, if they are near ones, to enter into this plan, or your labors will be of little value." Had his advice been followed and the work of burning all Black Knot wherever found been systematically undertaken at that time and enforced by wise laws supported by strong public sentiment in their favor, there is little reason to doubt that in the favored localities along the Hudson River commercial plum orchards might have been paying good profits for the last twenty years instead of presenting as they do discouraging pictures of loss and decay.

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\* Fruits and Fruit Trees of America, p. 269.

A reliable nurseryman recently made the statement that "Twenty years ago there were shipped from Geneva to the Hudson River country from twenty thousand to twenty-five thousand plum trees annually, where now few or none are sent and the reason for this loss to the nursery trade is fully accounted for by the fact that the Black Knot has become so destructive that no one dares to invest his money in plum growing in that section."

The following brief accounts of destruction of plum trees by the Black Knot are sufficient in themselves to show that this disease must be placed on the list of serious public pests and like the glanders or pleuro-pneumonia is a fit subject for special legislation designed for its eradication or control.

Mr. Geo. T. Powell of Ghent, Columbia Co., N. Y., who is director of the Department of Farmers' Institutes of the New York State Agricultural Society, writes as follows :

"The Black Knot has swept the plum growing interest nearly out of existence in the Hudson River Valley. When the orchards were being cut down and planting had ceased I put out an orchard of one thousand trees and for seven years I successfully kept it off. Each year there would be some formation but we very persistently kept it off. Last spring there was none to be seen on my trees when they were in bloom having taken every particle off very closely. On the first of September every portion of the trees was completely covered and the entire tops of all trees will have to come off.

So great was the attack that when I discovered it I had to abandon all efforts to take it off. Even the twigs upon which the fruit had set were so enlarged by the Knot that the fruit on them was deformed.

We had had three wet seasons previous to 1891, and while 1891 was quite dry, the conditions had been favorable for a great development of the fungus and the attack exceeded anything I had ever known. There were old trees adjoining my farm from which I think the trouble was spread over my orchard. My orchard is highly cultivated and fertilized but I notice that uncared for trees were as badly effected in this locality as mine were."

The following statements kindly furnished by Mr. P. Groom Brandow of Athens, Green Co., N. Y., indicate the former ex-

tent and value of the plum industry in that region and its total devastation by the Black Knot.

He states that, beginning at Cedar Hill about four miles below Albany, the plum district included a belt about three miles on each side of the river and extended southward about thirty-six miles to Germantown. He began setting plums for a commercial orchard in 1861 and at one time had six thousand trees. Two of his neighbors each had about two thousand trees, and most of the farmers went into the business to a greater or less extent.

It was no uncommon thing for a steamer to carry from one hundred to five hundred barrels of plums to New York at one trip. For four days picking in one week he received \$1,980.00. In 1884 he netted \$8,000.00 from his plums, and the next year he rooted out over five thousand trees on account of the Black Knot. From twenty-five hundred young trees two to three years old, left at that time, he thinks he has not yet realized over \$250.00.

One instance is cited of a young orchard set within a few hundred yards of an old orchard that had been destroyed by the Black Knot and within two years the young orchard had to be rooted out on account of the same disease.

Mr. Brandow further says that he knows of but one man who has set any plums within the last six years, and this orchard is a failure. The Knot became the most destructive about 1869 and has continued its ravages till the whole plum industry in this region is practically wiped out of existence by it.

Mr. Brandow is in his seventy-fourth year. His whole life has been spent on the old homestead and as far back as he can remember the Knot has infested their plum and cherry; but when the trees were ruined they were pulled out and new ones set again. He thinks that at least four times in his remembrance he has seen these epidemics of the Black Knot come and go.

When the disease began to attack his trees about the year 1870 he commenced cutting out the Knot and continued the warfare twelve or fourteen years and believes that he could have controlled it but for his neighbors trees which were infested with the disease. As it was, his orchard was the last to go down. He says he did not practice burning the knots, but now thinks this was a great mistake. He would not advise any one to set trees in a locality where there are old plum or cherry trees covered with Black Knot.

At a meeting of the Western New York Horticultural Society held in Rochester, January 27, 1892, the following resolutions were unanimously adopted :

WHEREAS, The interest we here represent involves expenditure and a large outlay of capital for years before any adequate returns are received ; and

WHEREAS, The risks attending the growing of fruit from the depredations of insect life and fungoid diseases are so rapidly on the increase as to be a source of the greatest anxiety and alarm to all engaged in the business ; and

WHEREAS, at this time there is great reason to fear that the total extermination of the plum and cherry orchards of the state may follow the rapid spread of one of these diseases, which science has demonstrated may be arrested in its destructive work by the enforcement of a proper law, such as has already been enacted for stamping out the disease in peach trees known as the peach yellows ; now, therefore,

*Resolved*, That it is the unanimous sense of the fruit growers in this meeting assembled, that it is of vital importance to them and their interests demand that the Legislature of this state shall, without delay, enact such a law as shall, in its enforcement and execution, thoroughly and effectually exterminate that infectious and incurable disease known as the Black Knot.

Mr. S. D. Willard of Geneva was appointed a committee to draft such a law and present it to the legislature At the present writing the law has been introduced into the legislature and will undoubtedly be passed.

It is believed therefore that a bulletin giving the life history of the fungus which causes the Black Knot, although the facts presented are not new to science, will be especially valuable at the present time because there are yet many persons interested in plum culture who do not realize the very dangerous and destructive character of the disease and who have no definite idea of its cause and the means by which it rapidly spreads from tree to tree.

A more general understanding of the reasonableness of the legislation referred to and of the importance of vigorously following its provisions will undoubtedly insure the hearty support and thorough enforcement of this law.

#### CAUSE OF THE DISEASE.

¶ It was formerly believed that Black Knot was produced by some gall insect, and it is not strange that this opinion prevailed on account of the gall-like character of the knots and the fact

that they are frequently infested by insects. Some believed it to be the work of the curculio, others thought that it was not the curculio, but some other insect or cause that produced the knots. But several years ago Dr. Farlow published in the First Annual Report of the Bussey Institute the results of his investigations which proved conclusively that the Black Knot is caused solely by a parasitic fungus which grows within the bark and which is

now known to science by the name of *Plowrightia morbosa*.

It is recognized as growing on cultivated cherries and also on the wild red or yellow plum (*Prunus Americana*), the Chicasaw plum (*P. Chicasa*), the chokecherry (*P. Virginiana*), the wild red cherry (*P. Pennsylvanica*), and the wild black cherry (*P. serotina*).

It is commonly most destructive to the plum but also seriously attacks the cherry. De. Schweinitz mentions an epidemic of Black Knot which destroyed the cherry trees at Bethlehem Pa. in 1790, and in various parts of the country to-day the disease seems to be almost, if not quite, as bad on cherry as on plum.

#### EXTERNAL CHARACTERS.

The external appearance of the mature form of the Black Knot is generally well known. It appears at this stage as a rough, wart like excrescence or distorted outgrowth from the bark of twigs and branches and in severe cases may extend along the trunk for several feet.

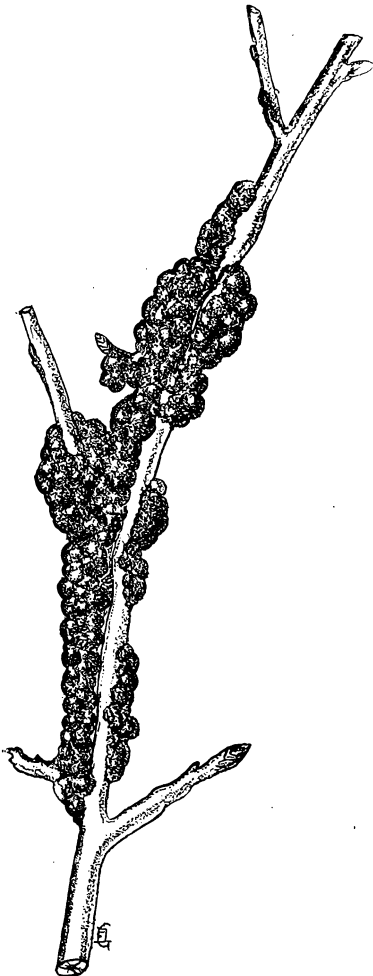


FIGURE IV.—An old knot (natural size).

Figure IV represents a mature knot on a small twig and Figure V is from a photograph of a young tree showing the upper part of the trunk nearly covered with the Knot which has checked its upward growth and caused the large development of the branches at the side. In many places Knots have formed on these branches also. The fungus may appear on any part of the tree above ground and no portion of either trunk or branches is exempt from its attacks.

#### BOTANICAL CHARACTERS.

The first outward sign of the formation of a new knot is seen in a swelling of the tissue within the bark either in the fall or during the growing season of the tree. The swelling increases till the bark is ruptured and as shown in Figure VI, over the surface thus exposed the fungus sends out numer-

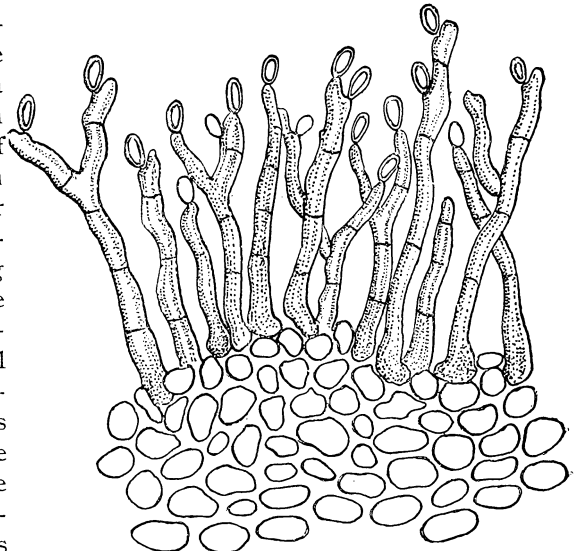


FIGURE VII.—A portion of a young knot, highly magnified.

ous threads (hyphæ) which produce a velvety appearance and are of an olive green color. Microscopic examination of the velvety surface reveals multitudes of newly formed and forming spores borne on these upright threads. A forming knot of this kind is shown in Figure VI.

These spores (conidia) are called summer spores. When full grown they drop off from the supporting threads, and when carried by winds, insects or other agencies, to another host plant, under favorable conditions they may start growth and form a new



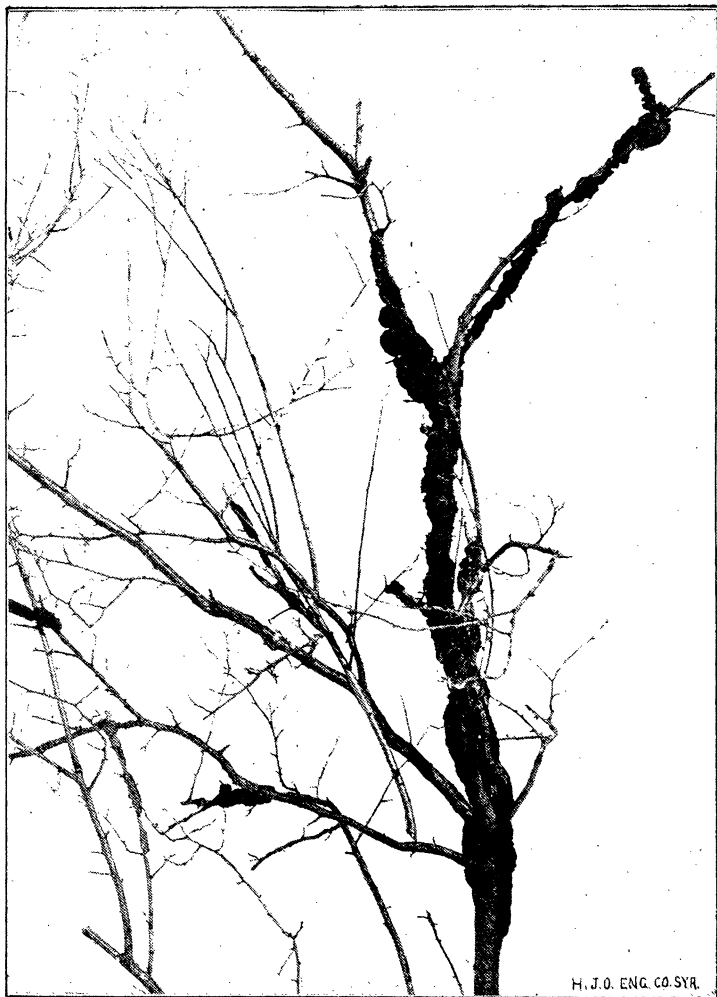


FIG. V.—*Portion of young tree badly affected with Black Knot (from a photograph).*



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FIG. X.—*Portion of an old fence row showing plum trees badly infested with Black Knot (from a photograph).*

center of disease from which in time other trees may also be infested and thus spread the disease from tree to tree and neighborhood to neighborhood.

Figure VII shows a few of the threads of the velvety surface above mentioned and also the outlines of the cells of the underlying tissue. At the extremities of some of the threads are seen the small oval summer spores. Figures IV, VI, VII, VIII and IX were kindly furnished by Dr. B. D. Halsted of the New Jersey Experiment Station.

The wonderful provisions for the reproduction of its kind are not ended by growing a crop of summer spores. After a time the production of summer spores ceases the, velvety threads die away and the surface of the Knot becomes hardened and gradually changes in color to dark brown and finally to black.

Late in the fall the surface of the Knot appears to be covered with pimples visible to the naked eye. These pimples are the outside covering of a tiny spherical case which may be called a spore case (perithecium). A slice across the pimpled surface with a sharp knife or razor will frequently show the white contents of the spore case visible to the naked eye. Such a section much enlarged is pictured in Figure VIII.

The outside rows of cells form the black hard covering of the spore case just referred to, making a hollow sphere within which are developed the winter spores. These winter spores ripen inside of long colorless sacs (asci) well shown in Figures VIII and IX and each sac when matured contains eight spores (ascospores). A microscopic examination of one of these spore cases in the fall discloses the fact that the winter spores are not yet formed.

It has been found that they do not develop till



FIGURE VI. — A forming knot.

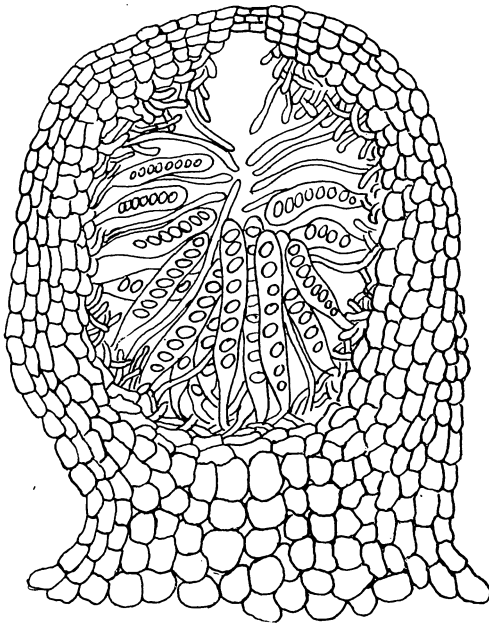


FIGURE VIII—Magnified view of space cavity.

which do not bear spores. Eventually the spore sacs break away and the spores which they have borne escape from the spore case and are carried by the winds or other agencies to infect new localities or other parts of the tree on which they have developed. ]

In figure IX is also seen a single spore free from the spore sac. It has begun to grow and has sent a germinating thread from each end of the spore. One of these threads has already branched. Under favorable conditions these threads grow quite rapidly and the interlacing branches form a perfect mat of threads (mycelium). When growing within the

winter and that they become mature and are capable of germination in February or March. Figure IX shows two spore sacs like those seen in figure VIII but more highly magnified. The spore sacs rise from a mass of threads which line the inner walls of the spore case; mingled with the projecting spore sacs are numerous sterile threads like the two shown in the figure

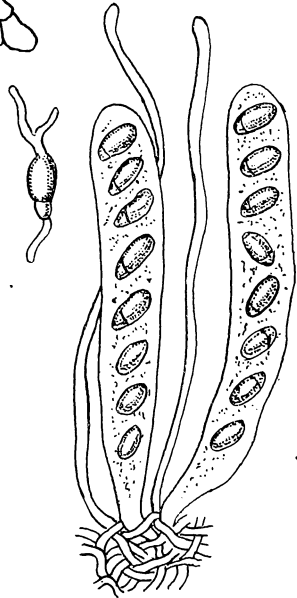


FIGURE IX—Two spore-sacs, and a free spore germinating.

bark of the plum or cherry trees these threads absorb their nourishment from the surrounding tissue and produce in succession the swelling and rupture of the bark, the formation of summer spores, the development of the Black Knot, and lastly within the Black Knot are formed myriads of the winter spores.

Both summer and winter spores are produced in great numbers, really in incalculable numbers, and by their agency the disease assumes an infectious character and spreads from tree to tree and from community to community. The fungus is perennial and, having once gained lodgment in a tree continues to form new knots and to develop the succession of summer and winter spores year after year.

#### REMEDIES.

Is it not plain, therefore, that the best way to deal with thoroughly infested trees is to cut them down and burn them at once thus insuring the destruction of the spores before they spread the disease any further? Trees not badly infested may be treated by cutting off affected branches some distance below the knot. This operation is best performed in the fall immediately after the foliage drops because the winter spores are not formed at that time and consequently there is less danger of their being disseminated in the operation and also because the work can be done more thoroughly when there are no leaves to hide the knot.

The summer spores must also be taken care of in their season. As soon as there are any indications of the formation of a new knot in the spring or during the summer the branch on which it occurs should be cut and burned. The first outbreak will probably be noticed about the middle of May.

It is important to note that if a branch containing the Knot be cut from the tree and thrown on the ground the spores will ripen in due time just the same. Therefore, the practice of collecting carefully and burning every Knot cannot be too strongly urged.

The bulletins of the Massachusetts Experiment Station contain reports of some experiments in the application of various substances for the purpose of destroying the knot. Kerosene, turpentine, linseed oil, sulphate of copper and a mixture of red oxide of iron and linseed oil are mentioned as among the substances tried. These seem to be effective in destroying warts to which

they are applied to saturation but care must be used with the turpentine and kerosene or the entire branch will be killed.

But the great trouble with many plum growers is one which these remedies fail to reach, namely—the production of spores on the Knot infested trees of their neighbors. Against the disease in such places the careful fruit grower can at present oppose only persuasion hoping by this means to secure his neighbor's coöperation in a campaign of extermination against the Knot.

Figure X is from a photograph of a few neglected trees along an old fence where a plum thicket has been allowed to grow. A close examination will show that the healthy bark on the trees represented in this picture is quite smooth while the dark and enlarged trunks or twigs reveal the presence of the Knot.

A fence row like that of which a portion is shown in figure X produces enough Black Knot spores each year to infect the whole neighborhood. Many such places in the State spread their seeds of destruction on the winds year after year and persons in their neighborhood who are trying to grow plums either for home use or for market are powerless to protect their trees from the invasion of the dreaded disease.

Concerted action on the part of all who are interested in growing plum and cherry trees can do much towards eradicating the Black Knot. For those cases that can not be reached by other means it would seem right that proper legislative enactment be provided so that the fruit grower may protect his orchard from all infected trees of the vicinity. Let it be remembered that in the work of thorough eradication of the disease the wild plum and cherry trees before mentioned as host plants of the Black Knot must not be neglected.

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