New York Agricultural Experiment Station.

BULLETIN No 98—NEW SERIES.

JANUARY, 1896.

PART I.—PLUM LEAF SPOT.
PART II.—CHERRY LEAF SPOT AND FRUIT ROT.

BY S. A. BEACH.

GENEVA, N. Y.

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NEW YORK AGRICULTURAL EXPERIMENT STATION,
GENEVA, N. Y., Jan. 16, 1896.

HON. FRED C. SCHRAUB, *Commissioner of Agriculture.*

SIR: During the summer of 1895 a comparison was made of two spraying mixtures for the prevention of cherry fruit rot and cherry leaf spot. The experiments were conducted in Orange County under the direction of this Station. The bulletin herewith submitted for publication under chapter 509, laws of 1895, contains an account of these experiments and also of experiments for treating plum leaf spot.

L. L. VAN SLYKE,
Acting Director.

PART I. PLUM LEAF SPOT.

In 1892, 1893 and 1894 the plum leaf spot disease was checked in an orchard of T. C. Maxwell & Bros. by the use of eau celeste soap mixture applied late in July and in August.

In 1895 experiments were conducted by this Station to determine the value of eau celeste soap mixture as compared with Bordeaux mixture for preventing the leaf spot.

It was planned to make three series of treatments, namely:

Series I.	First application just before blossoms open.
	Second application just after blossoms fall.
	Third application from ten to fourteen days after the first.
Series II.	First application just after blossoms fall.
	Second application from ten to fourteen days after the first.
	Third application about June 15.
Series III.	First application about June 15.
	Second application about July 15.
	Third application about August 15.

The treatments were made with both mixtures according to the plan outlined except that in the second application of series III eau celeste was used on three trees only because of the injury to the foliage which had followed its use earlier in the season. On account of the generally healthy appearance of the foliage the treatment of series III planned for August 15 was not given either with Bordeaux mixture or with eau celeste.

From the results of these experiments it appears that:

1. Bordeaux mixture is perferable to the eau celeste soap mixture as a preventive of plum leaf spot.

2. The good effects which followed the use of the eau celeste soap mixture before mid-summer, were counterbalanced to a considerable degree by the injury which the mixture did to the foliage.

3. But little of the leaf spot disease was seen in the early part of August, even on unsprayed trees, so that

no comparison was made of the values of the two mixtures for August treatment.

4. Bordeaux mixture is preferable to the eau celeste soap mixture as a preventive of plum leaf spot, as was shown by the results of treatments made in May, June and July.

5. The first spraying should be made soon after the blossoms fall; the second from ten to fourteen days later and the third about the middle of June. If after this treatment the leaf spot becomes abundant Bordeaux mixture may be used as late as the middle of July after which if treatments are necessary, eau celeste soap mixture may be used as it does not discolor the fruit as much as Bordeaux mixture does.

6. The treatment above outlined may be expected to largely prevent the leaf spot disease and also to lessen the attacks of fruit rot and black knot.

The appearance and nature of the leaf spot and the manner of conducting the investigations are explained in the following pages.

PART II. CHERRY LEAF SPOT AND FRUIT ROT.

In 1895 experiments were couducted in the cherry orchard of W. D. Barns & Son, Middle Hope, N. Y., for the purpose of comparing the values of eau celeste soap mixture and Bordeaux mixture for preventing the leaf spot disease and the fruit rot.

The plan of the experiments was quite similar to that outlined above for treating plum leaf spot. The results of the investigations may be briefly stated as follows:

1. On Montmorency trees sprayed with Bordeaux mixture May 14, May 29 and June 15, only a slight amount of rot was found while on adjacent trees of the same variety which were not sprayed from one-twentieth to one-fifth of the fruit rotted.

2. On Montmorency trees sprayed June 15 with eau celeste soap mixture, only a slight amount of rot was found while on adjacent unsprayed trees from one-twentieth to one fifth of the fruit rotted.

3. From the middle of June till the close of the season the unsprayed trees had much more and better foliage than did the trees which had been sprayed.

4. Generally the injury to the leaves was much greater on the trees which were sprayed with eau celeste than it was on the trees sprayed with Bordeaux mixture but on one group of Reine Hortense the Bordeaux mixture caused the greater injury.

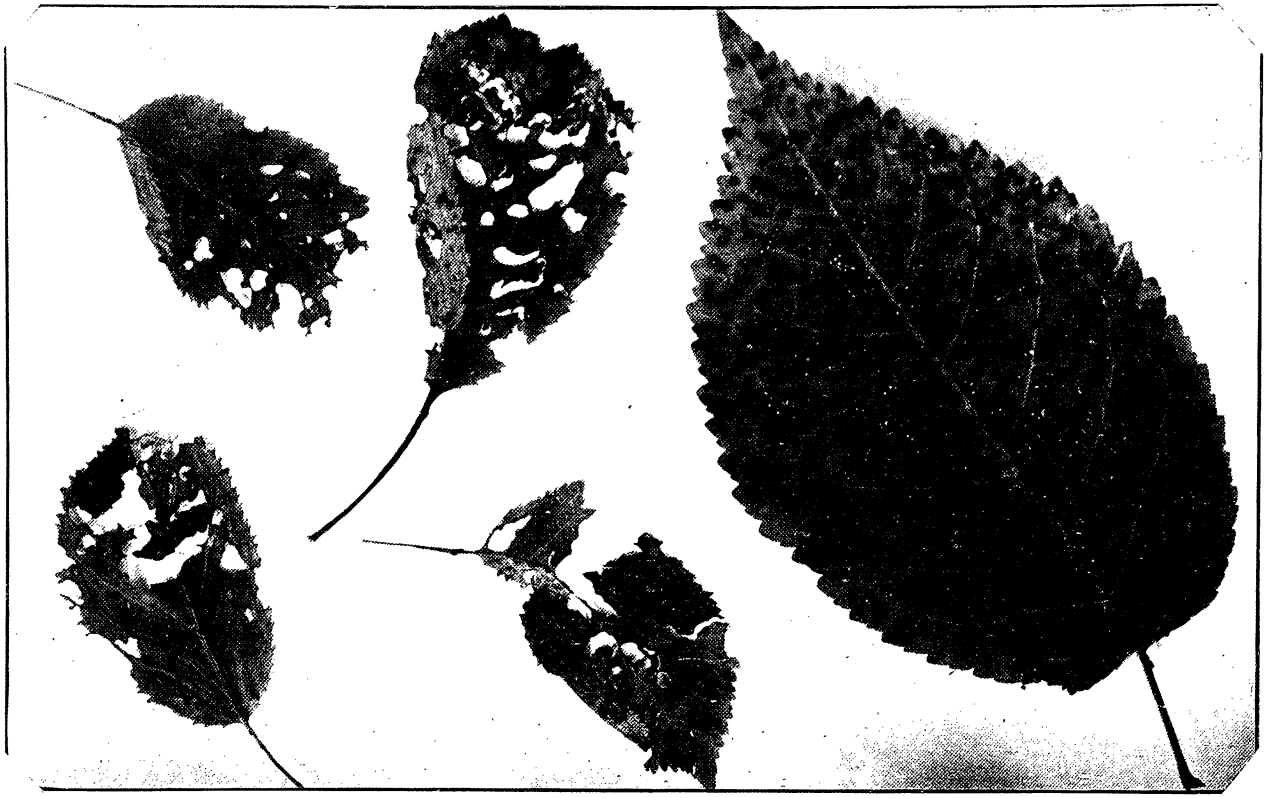

PLATE I.—*Leaf-spot disease on cherry leaves.*

PART I. PLUM LEAF SPOT.*

INTRODUCTION.

One of the serious diseases with which the plum-grower has to contend is the plum leaf spot also known as the plum leaf blight and shot-hole disease which is caused by a fungous parasite. It is quite widely distributed in Europe and America not only on plum but also on cherry and some other stone fruits.

APPEARANCE. In the plum orchard it makes its appearance soon after the first leaves are full grown. The leaves begin to show little discolored spots, at first about a sixteenth of an inch in diameter, with margins often tinged with purple or red. As the disease progresses the spots enlarge till they are an eighth of an inch or more across. Larger spots may be formed by the coalescing of several small ones. The spots soon become dark brown with a pale center. The tissues wither and frequently, breaking away from the healthy portion of the leaf which surrounds them, they drop out and leave circular holes in the leaf as illustrated in plate I which is reproduced from a photograph of diseased leaves. The holes thus formed are often as clean cut and clearly defined as though they had been made with shot and on account of this characteristic the disease is sometimes called the shot-hole disease. Inasmuch as another disease which attacks apricots, almonds and other stone fruits is popularly known, especially in California, as the shot-hole disease it is better to designate the trouble which we are discussing as the leaf spot disease of plum and cherry. The holes which are formed in the leaves by this disease are not always circular in form but when several spots coalesce into one, or when the disease finds extremely favorable conditions for rapid development, large patches irregular in shape may drop from the leaf, giving the foliage a ragged or worm eaten appearance.

INJURIOUS EFFECTS. The infested leaves frequently turn yellow and drop prematurely so that it is not uncommon in August to see a large proportion of the new growth leafless, or in case of very severe attacks the tree may lose nearly all of its foliage be-

* *Cylindrosporium Padi*, Karsten.

fore September. Without the help of the foliage it is unable to properly ripen its wood and in such instances, especially when it has borne a heavy crop of fruit, it goes into the winter in an enfeebled condition and is liable to be severely injured or even killed by the winter. The leaves may begin to drop to a considerable extent as early as July but usually the loss from dropping is not serious before August or September.

The disease frequently checks the growth of plum and cherry nursery stock so much that it is difficult to bud them in August. It also interferes with the growth of the budded trees. See Annual Report of this Station 1893, 688–693.

The nature of the leaf spot is such that the disease may pass unnoticed or attract little attention unless it causes the leaves to drop badly. Should the loss of foliage not exceed five or ten per cent., a person unacquainted with the disease would be apt to think that the few leaves which dropped from time to time did so as a result of natural process of ripening rather than because they were attacked by the leaf spot fungus, and failing to realize the danger of serious loss from this trouble he would take no precautions to prevent the progress of the disease.

Many fruit growers do not realize as they should how essential healthy foliage is to the vigor, longevity and productiveness of trees. It is too often the case that a loss of five or ten per cent. of the foliage causes little anxiety, yet this means a loss of five or ten per cent. in the productive power of the tree. It is in the leaves, or other green portions of the plant, that the compounds are formed which are used to sustain life, to support new growth of wood, foliage or fruit, and to develop the fruit buds for another crop. The roots gather crude food materials from the soil, other material is supplied by air and then with the help of sun heat and sunlight, in the green portions of the plant these are formed into starch, sugar or other compounds which the plant may either appropriate for immediate needs or store away for future use. The leaves may properly be called the food factory of the tree. Is it not wisdom to protect this factory, so far as practicable, from all attacks of insects or diseases, that it may do its work perfectly and so enable the tree to yield an abundance of fruit of the highest possible excellence?

BORDEAUX MIXTURE A PREVENTIVE. Experiments conducted at various Experiment Stations during the past few years show that the leaf-spot of plums may be controlled by the use of Bordeaux mixture[1], and this conclusion has been confirmed in the practical experience of many fruit growers. It has also been demonstrated that a mixture as weak as one pound of copper sulphate for eleven gallons is efficient in controlling the disease when properly used.[2] But the least number of treatments necessary for controlling the leaf spot and the best time for making these applications have not yet been satisfactorily established.

EXPERIMENTS WITH REMEDIES IN 1895. During 1895 experiments were conducted by this Station primarily to compare the value of Bordeaux mixture with eau celeste soap mixture for preventing plum leaf blight. It was expected that these experiments would also throw some light on the questions as to the fewest number of treatments necessary to control the disease and the best time for making the applications.

During the last three years in one of the extensive plum orchards of T. C. Maxwell & Bros. of Geneva, eau celeste soap mixture has been used with very good results for checking the spread of the leaf spot late in summer. For this reason it was decided to compare the Bordeaux mixture with the eau celeste soap mixture as a remedy for this disease. Previous comparisons of these two fungicides have usually resulted in favor of the Bordeaux mixture when considered either with reference to its effectiveness against the spread of fungi or with reference to its effect on the health of the foliage. Were eau celeste as good a fungicide as Bordeaux mixture it would be more desirable. It is made by adding ammonia to a solution of copper sulphate, and

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[1] Thaxter, Roland. Rep. Conn. Sta. **1889**: 176, **1890**: 102.

Green, W. J. The Shot-hole Fungus of the Plum. Bull. Ohio Exp. Sta. 1891. II, **4**: 216.

Fairchild, D. G. Plum Leaf Blight. Bull. U. S. Div. Veg. Path. 1894, **6**: 39–40. Jour. Myc. **7**: 253–256 pl. 2., Rep. N. Y. State Exp. Sta. 1892, **11**: 659–663. Treatment of Plum Leaf Blight in Nursery. Bull. U. S. Div. Veg. Path. 1892, **3**: 63–64.

Beach, S. A. Preventing Leaf Blight of Plum and Cherry Nursery Stock. Rep. N. Y. State Exp. Sta. **1893**: 688–693. Bull. N. Y. State Exp. Sta. 72.

[2] Green, W. J. Bull. Ohio Exp. Sta. **1891**: 216.

Beach, S. A. Rep. N. Y. State Exp. Sta. **1893**: 688–693.

as it contains no heavy sediment it does not need to be agitated and is easier to apply than is Bordeaux mixture.

The following is the history of the use of eau celeste in the plum orchard above referred to, as given by the manager, Mr. C. K. Scoon:

In the summer of 1892 the foliage began dropping from a block of Bavay's Green Gage to an alarming extent. The trees had been sprayed twice in the spring with Bordeaux mixture although not so thoroughly as they should have been At the suggestion of Mr. D. G. Fairchild an Eau Celeste soap mixture was tried to see if it would check the trouble. Three applications were made, at intervals of about ten days, beginning the last of July and extending into August. The immediate result was that the spread of the disease seemed to be checked. The most marked result was apparent in the fall, when the untreated trees dropped nearly all of their foliage before the fruit was picked while the sprayed trees retained their leaves till late in the season. The following winter was quite severe on plums and many trees were injured. Those trees which had been sprayed and held their leaves late in the fall were injured less than those trees which were not sprayed and which lost their leaves earlier.

In 1893 the trees were sprayed in the spring with Bordeaux mixture more thoroughly than they had been in the previous year. Two applications of the eau celeste were made, one the latter part of July the other in August. The contrast between the treated and untreated trees was not so great as in the previous year, as the untreated trees held their foliage well, but in the fall it was noticed that the treated trees held their foliage longer than the untreated.

In 1894 a block of Italian Prune was given treatment similar to that which the Bavay's Green Gage received in 1893 and with similar results.

Plan of Experiments in 1895. Messrs. T. C. Maxwell & Bros. kindly offered one of their plum orchards for the use of the Station in conducting the experiments in 1895. A block of five hundred and sixty-seven trees were selected for this purpose. The varieties included in this block were Italian Prune, Guii, Lombard, Purple Egg and Bavay's Green Gage, familiarly known here as *Reine Claude.* One-third of the trees of each variety were treated with Bordeaux mixture, as explained hereafter, one-third were similarly treated with eau celeste soap mixture and one-third were left untreated for comparison. The experiments were therefore complete with each of the varieties named above so that the

Treatment.		Bavay's Green Gage.	Purple Egg.	Lombard.	Guii.	Italian Prune.
		1 2 3	4 5 6 7	8 9 10 11	12 13 14 15	16 17 18 19 20 21
Section 1. Eau celeste soap mixture. May 1, May 17 and June 1.	1	. . .	. . . .	. . . .	. . . .	. . . . .
	2	. . .	. . . .	. . . .	. . . .	. . . . .
	3	. . .	. . . .	. . . .	. . . .	. . . . .
Section 2. Bordeaux mixture. May 1, May 17 and June 1.	4	. . .	. . . .	. . . .	. . . .	. . . . .
	5	. . .	. . . .	. . . .	. . . .	. . . . .
	6	. . .	. . . .	. . . .	. . . .	. . . . .
Section 3. No treatment.	7	. . .	. . . .	. . . .	. . . .	. . . . .
	8	. . .	. . . .	. . . .	. . . .	. . . . .
	9	. . .	. . . .	. . . .	. . . .	. . . . .
Section 4. Eau celeste soap mixture. May 17, June 1 and June 15.	10	. . .	. . . .	. . . .	. . . .	. . . . .
	11	. . .	. . . .	. . . .	. . . .	. . . . .
	12	. . .	. . . .	. . . .	. . . .	. . . . .
Section 5. Bordeaux mixture. May 17, June 1 and June 15.	13	. . .	. . . .	. . . .	. . . .	. . . . .
	14	. . .	. . . .	. . . .	. . . .	. . . . .
	15	. . .	. . . .	. . . .	. . . .	. . . . .
Section 6. No treatment.	16	. . .	. . . .	. . . .	. . . .	. . . . .
	17	. . .	. . . .	. . . .	. . . .	. . . . .
	18	. . .	. . . .	. . . .	. . . .	. . . . .
Section 7. Eau celeste soap mixture. June 15 and to trees 19, 20, and 21 of row 1 only, July 16.	19	. . .	. . . .	. . . .	. . . .	. . . . .
	20	. . .	. . . .	. . . .	. . . .	. . . . .
	21	. . .	. . . .	. . . .	. . . .	. . . . .
Section 8. Bordeaux mixture. June 15 and July 16.	22	. . .	. . . .	. . . .	. . . .	. . . . .
	23	. . .	. . . .	. . . .	. . . .	. . . . .
	24	. . .	. . . .	. . . .	. . . .	. . . . .
Section 9. No treatment.	25	. . .	. . . .	. . . .	. . . .	. . . . .
	26	. . .	. . . .	. . . .	. . . .	. . . . .
	27	. . .	. . . .	. . . .	. . . .	. . . . .

trees that were sprayed with the Bordeaux mixture may in each case be compared with others of the same variety that were sprayed with the eau celeste and also with others of the same variety that were left unsprayed. The accompanying plan shows the location of the varieties with respect to each other and indicates the treatment of each section.

This plan included three series of treatments.

Series I. Consisting of three sprayings. The first spraying was made May 1 when the buds were breaking; the second was made May 17, just after blossoming, and the third was made June 1.

Series II. Consisting also of three sprayings, was begun May 17, just after blossoming; the second spraying was made June 1 and the third, June 15.

Series III. It was proposed to make three sprayings in the third series, one about June 15; the second about July 15, and the third about Aug. 15. The first spraying was made June 15, using Bordeaux mixture and eau celeste according to the original plan; the second was made July 16 with the Bordeaux mixture but on account of the injury which had followed the use of the eau celeste soap mixture it was applied at this time to three trees of the Bavay's Green Gage only. The proposed third spraying was not given either with Bordeaux mixture or with the eau celeste soap mixture, on account of the generally healthy condition of the foliage in mid-summer.

FORMULÆ. The *eau celeste soap mixture* which was used in these experiments was made according to the formula followed by Mr. Scoon in previous years. One pound of copper sulphate was dissolved in water and diluted to about forty gallons. A quart of 26° ammonia was then added and a pound of whale-oil soap dissolved in water. The whole mixture was then diluted to fifty gallons. This formula calls for an excess of ammonia.

The *Bordeaux mixture* was made by dissolving one pound of copper sulphate in about eight gallons of water. Fresh slaked lime was then diluted with water and added in excess of the amount called for by the potassium ferro-cyanide test. The whole mixture was then diluted to eleven gallons.

RESULTS. The leaf spot disease was not so abundant in this orchard in 1895 as it has been in some previous years so that with some of the varieties the effects of the treatment were not so pro-

PLATE II.—*Plum trees defoliated by leaf-spot.*

PLATE III.—*Italian Prune unsprayed.*

PLATE IV.—*Italian Prune sprayed with Bordeaux mixture.*

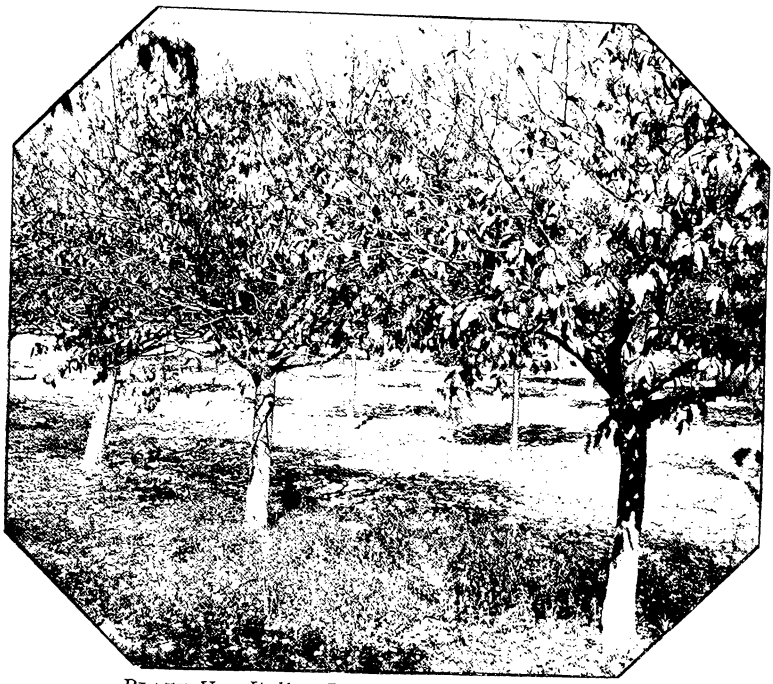

PLATE V.—*Italian Prune sprayed with eau celeste.*

nounced as they undoubtedly would have been had the disease been more prevalent. The Italian Prunes suffered most and so the experiments with this variety are selected to show the comparative merits of the different treatments. Plate II reproduced from a photograph made September 28, 1895, shows in the foreground an unsprayed Guii tree, still holding a considerable amount of its foliage. Immediately behind it in the same row are seen some unsprayed Italian Prune trees which are nearly leafless. This picture illustrates well the general difference between unsprayed trees of these two varieties on that date. The leafless condition of unsprayed Italian Prunes is still better shown in plate III which is also reproduced from a photograph taken Sept. 28, 1895. These trees had gradually lost their foliage from the attacks of the leaf spot disease. A very careful estimate of the injury or loss of foliage from all causes, which was made September 28, gave the following results:

Series I. Treated May 1, May 17 and June 1.	Bordeaux mixture	24 per cent. injury or loss.
	Eau celeste soap mixture	66 per cent. injury or loss.
	No treatment	95 per cent. injury or loss.
Series II. Treated May 17, June 1 and June 15.	Bordeaux mixture	10 per cent. injury or loss.
	Eau celeste soap mixture	73 per cent. injury or loss.
	No treatment	78 per cent. injury or loss.

It appears from this table that much better results were secured with the Bordeaux mixture than with the eau celeste soap mixture. This is well illustrated by comparing plate IV with plates III and V. Plate IV is from a photograph of Italian Prunes which were included in Series II, and sprayed with Bordeaux mixture May 17, June 1 and June 15. Plate V is from a photograph of corresponding Italian Prune trees which were sprayed on the same dates with the eau celeste soap mixture. Plate III is from a photograph of corresponding Italian Prune trees which were not sprayed at all. All photographs were taken September 28, 1895.

Best Time for Treatment. As before stated, one of the objects of the investigations in 1895 was to discover the fewest number of treatments that will be necessary for controlling the disease and the best time for making the applications. The results

of the treatment with Bordeaux mixture according to the plan previously explained throw some light on these questions.

It will be remembered that three series of treatments were made. In series I the first spraying was given May 17, when the buds were breaking; the second was given just after the trees had gone out of blossom; the third was given June 1. In series II the first spraying was made May 17, the second was made June 1 and the third was made June 15. In series III the first treatment was made June 15, the second was made July 16. The estimate of the amount of loss or injury to the foliage from all causes, which was made September 28, gave the following results:

Series I. Treated May 1, May 17 and June 1.	Bordeaux mixture No treatment	24 per cent. injury or loss. 95 " " " "
Series II. Treated May 17, June 1 and June 15.	Bordeaux mixture No treatment	10 per cent. injury or loss. 78 " " " "
Series III. Treated June 15 and July 16.	Bordeaux mixture No treatment	41 per cent. injury or loss. 96 " " " "

Judging from these results it is not best to make the first treatment later than the first of June. Arthur[1] has shown that the leaf-spot fungus lives over winter in the infested leaves and that the spores of the mature form of the fungus begin to ripen about the first of June. In the above experiments the best results were secured when the foliage was covered with Bordeaux mixture before the time when these spores are said to ripen, that is to say, before June 1. This confirms the results secured by Thaxter.[2]

[1] Arthur, J. C. Plum Leaf Fungus. Rep. N. Y. State Exp. Sta. **1887. 6:** 347–350. f. 2.

[2] Thaxter, Roland. Rep. Conn Sta. **1889:** 176. **1890:** 102.

Dr. Thaxter reports an experiment in 1889 in which two Lombard trees were sprayed with Bordeaux mixture, 1–3⅔ formula, May 22, June 14 and July 16. A third tree was left unsprayed for comparison. The two sprayed trees held their foliage intact up to severe frost in October, showed hardly any black knot and matured a fair amount of fruit. The untreated tree was leafless in August, matured no fruit and was badly infested with black knot. "The mixture did not adhere to the fruit to any extent, which may account for the fact that the fruit rot was not more effectually controlled."

In 1890 similar application was made to several large plum trees thereby preserving their foliage intact. In another place Bordeaux mixture was applied to plums and cherries with similar results while a few untreated trees lost their foliage in July.

BORDEAUX MIXTURE AS A PREVENTIVE OF BLACK KNOT AND FRUIT ROT —The treatment of plum trees with Bordeaux mixture for leaf-spot appeared in Dr. Thaxter's experiments to check the plum black-knot, as it did also in a later experiment by Lodeman.[1]

In treating peaches for the fungus which causes the ripe-rot of the fruit and the blight of the blossoms, Chester[2] has found that four sprayings with Bordeaux mixture, 1 to 7½ formula, reduced the rot to about one-third of what it was on unsprayed trees. He found that with two sprayings there was about twice as much rot as with four sprayings and that four sprayings gave about as

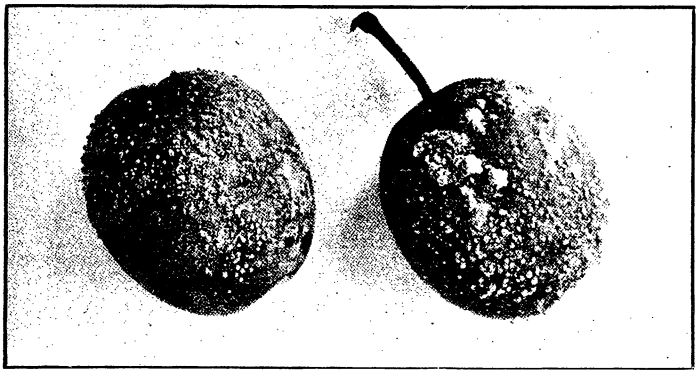

FIG. 1.—*Ripe-rot of Plums.*

good results as did six sprayings. Two of the four sprayings were made before the blossoms opened; the third was made two weeks after the date of full bloom and the fourth was made twelve days after the third.

The same fungus which causes the fruit rot of peaches also causes the ripe rot of plums and in some instances attacks the blossoms, giving them a blighted appearance. Figure 1 illustrates the appearance of fruit attacked by the fruit-rot fungus. It is gratifying to learn that Bordeaux mixture checks to some extent the spread of this disease, although as Dr. Thaxter has observed

[1] Lodeman, E. G. Spraying for Black-knot upon Cherries and Plums. Garden and Forest, **7**: 508.

[2] Chester, F. D. Bull. Del. Station **29**: 11.

in the citation given above, it is not always effective in preventing its ravages.

From these observations we conclude that the treatment which has been advocated above as a preventive of plum-leaf spot may also be expected to show some beneficial results in lessening the prevalence of fruit rot and black knot in the treated orchards. Nevertheless it is not expected that spraying will ever do away with the necessity of cutting off and burning the knots to prevent the spread of plum black-knot, and it will still be advisable to remove and burn or bury the rotted and mummified fruit before the blossoms open the following spring.

COURSE OF TREATMENT NOW ADVOCATED. Bearing in mind the various objects for which plum orchards are sprayed the following line of treatment appears to be the best known at present:

1. In case there is reason to fear an attack of the fruit rot fungus on the blossoms spray thoroughly with Bordeaux mixture before the blossoms open.

2. When no attack of the fruit rot fungus on the blossoms is feared let the first spraying be made soon after the blossoms fall. If Paris green is to be used against the curculio it may be mixed with the Bordeaux mixture at this time, using one pound to from two hundred and fifty to three hundred gallons of the mixture. The second treatment should be made about June 1 and the third about June 15. Should this treatment be insufficient to hold the disease in check a fourth spraying may be made about July 15. Later than this it would be better to use the eau celeste soap mixture because it would be less liable to spot the fruit than would Bordeaux mixture.

In conclusion it should be said that thoroughness in spraying is essential to success. This has been advocated over and over again in former bulletins and reports of this Station and yet probably nine-tenths of the readers who have undertaken to spray their orchards fail to secure the best results because the work is not done thoroughly. It is not necessary to drench the trees but the aim should be to completely cover every leaf with fine mist-like particles of the spray. To do this it is necessary to have a powerful pump and good nozzles. For a more complete discussion of spraying apparatus and methods of spraying the reader is referred to bulletin 74 or the 1894 annual report of this Station.

PART II. CHERRY LEAF SPOT AND FRUIT ROT.

The fungus which causes the leaf spot on plum also does great damage to the foliage of cherry trees in nursery and in orchard. It frequently happens that cherry nursery stock loses so much of its foliage from the leaf spot that the growth of the trees is checked and budding operations are seriously interfered with. In the orchard the loss of foliage, as has already been explained in speaking of the plum leaf spot, lessens the power of producing good fruit, of forming fruit buds for the next season, and of properly ripening the new growth before winter. The disease makes its first appearance and afterwards develops in a manner quite similar to that described for plums in Part I of this bulletin.

Cherry nursery stock was treated for the leaf spot at this Station in 1891 and 1892 by Fairchild. He concludes that[1] it may be stated conservatively that Bordeaux mixture, 1--10 formula, is a specific for this disease, and that it is undoubtedly superior to the ammoniacal solution of copper carbonate for this purpose.

The treatment of cherry trees of bearing age is reported in two or three instances, although in each case but few trees appear to have received treatment. Thaxter reports[2] that by use of Bordeaux mixture, 1 to 3⅔ formula, some cherry trees were protected from the leaf spot in 1890 while corresponding trees which were not so treated lost their foliage in July. The time of the applications and their number is not definitely stated.

Craig[3] reports that in 1894 a much weaker Bordeaux mixture than that used by Thaxter, namely, a 1 to 12 formula, was used against the fruit rot with good results. A Yellow Spanish tree sprayed May 1 with Bordeaux mixture and three times afterwards with the same mixture combined with Paris green, yielded ninety pounds of sound fruit while a corresponding untreated tree yielded but thirty pounds. Also, in another orchard, a tree was sprayed May 10, May 26 and June 4 with Bordeaux mixture and Paris

[1] Fairchild, D. G. Cherry Leaf Blight, Bull. U. S. Div. Veg. Pathology **6**: 38-39. Report of this Station, **1892, 11**: 654-659, pl. 2.

[2] Thaxter, Roland. Rep. Conn. Sta. **1890**: 102.

[3] Craig, John. Report Horticulturist, Canada Dept. Agr. **1894**: 112.

green, using one ounce of Paris green and one pound of copper sulphate for each twelve gallons of the mixture. July 4 it was sprayed with ammoniacal solution of copper carbonate. This tree yielded one hundred and thirty pounds of fruit while the corresponding unsprayed tree yielded but seventeen pounds.

OBJECTS OF TREATMENT. In spraying cherries it is desirable to prevent the leaf spot, the fruit rot, the mildew of the leaves, and the attacks of the curculio, an insect which causes wormy cherries. Some experiments with cherries similar to those described in Part I were planned in 1895 to determine if possible the comparative values of Bordeaux mixture and eau celeste soap mixture as preventives of the fungous troubles just named, but no attempt was made in these experiments to prevent the attacks of the curculio.

EXPERIMENTS OF 1895. Messrs. W. D. Barns & Son, Middle Hope, N. Y., kindly offered their orchard for the purpose of the experiments and cordially coöperated in the work. The details of the work were under the immediate supervision of Mr. Paddock, the Assistant Horticulturist of this Station.

One hundred and fourteen trees were set apart for the experiments. They included three varieties, namely: Reine Hortense, Early Richmond and Montmorency. Some of each variety were left untreated for the sake of comparing them with treated trees, some were sprayed with Bordeaux mixture and some with the eau celeste soap mixture.

Three series of treatments were planned. The treatments of the first series were made May 1, May 14 and May 29. The treatments of the second series were made May 14, May 29 and June 15. The first and only treatment of the third series was made June 15. The buds were well expanded May 1 when the first treatment was made, and the blossoms opened about four days later. May 10, just after the blossoms had fallen, the second spraying was made.

A careful examination of the trees June 15 showed that up to this time very little leaf spot was present either on sprayed or on unsprayed trees. The foliage on trees which had received the eau celeste treatment was somewhat spotted but this was probably largely due to the injurious effects of the spray. The untreated foliage and that treated with Bordeaux mixture appeared at this time to be perfectly healthy.

Two weeks later, June 28, Mr. Barns reported that the trees in series I which had received the Bordeaux mixture treatment showed a little injury to the leaves while the injury was bad on eau celeste treated trees of series II. The trees in series III which had received but one treatment with eau cleste already showed some injury to the leaves. On this account spraying was discontinued so that series III did not receive treatment July 15 and Aug. 15, as was at first planned.

FRUIT ROT CHECKED. So far as the fruit rot is concerned rather encouraging results were obtained although comparatively few of the trees fruited and even on unsprayed trees the rot was not generally abundant. A careful estimate made when the fruit was picked showed some advantage from the treatment. Especially in one group of trees the amount of rotted fruit was slight while on unsprayed trees of the same variety which stood near, from one-twentieth to one-fifth of the fruit rotted. In preventing the rot, the eau celeste seemed to be as effective as the Bordeaux mixture, but generally it injured the foliage much more than Bordeaux mixture did.

FOLIAGE INJURED BY SPRAYING. The results of the treatment for the leaf spot are not very encouraging because so much of the foliage was injured by the spray. The last spraying was made June 15 and from that time till the close of the season the unsprayed trees were generally speaking in better condition than were the trees which had been sprayed.

As a rule the leaves were hurt much less by the Bordeaux mixture than by the eau celeste. We were much surprised to find an exception to this in the Reine Hortense of series I where the leaves were hurt much more by the Bordeaux mixture than they were by the eau celeste.

CONCLUSION. In view of these results it seems best to make no recommendations at present as to the spraying of cherry orchards. It is expected that the investigation of this subject will be continued in 1896, and it is hoped that the results of that investigation will justify recommending a definite line of treatment for cherry leaf spot on bearing trees.