T H E S I S

on

STUDIES ON SEPTORIA LEAF-SPOT OF RUBUS

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STUDIES ON SEPTORIA LEAF-SPOT OF RUBUS

INTRODUCTION

It is the purpose of this paper to present the results of experiments on the susceptibility of certain species and varieties of Rubus to the leaf-spot disease caused by Septoria rubi Westendorp.

This study has by no means been exhaustive and no attempt has been made to cover the entire literature on this particular disease. While the information given here is far from complete, it is offered in the hope that some addition has been made to the already known facts relative to the leaf-spot disease.

The writer is deeply grateful for the kind assistance and advice given by Dr. S. M. Zeller and by Professor H. P. Barss throughout the course of this study. The writer also expresses his appreciation to other members of the Department of Botany and Plant Pathology for the suggestions and criticism offered from time to time.

The fungus known in literature as Septoria rubi Westendorp causes the most common leaf spot disease of blackberries and raspberries. Westendorp (1841-1859) described the fungus, under the name given above, in Belgium and issued it as number 938 of his Herbier Crytogamique Belge (1841-1859). Since the time of Westendorp's description, frequent notes on the occurrence of Septoria rubi in Europe, and later in North America, have appeared in mycological publications. Aside from these short mycological notes, little careful work has been done in connection with the causal organism of the disease. The fungus was first reported from America by Berkeley (1874).

Roark (1917) found the ascigerous stage in Wisconsin to be a species of Mycosphaerella which in its morphology does not agree with any published description of a fungus of this genus occurring on Rubus. He described it as a new species. His proof of the relation between the perfect and the imperfect form being based on (1) the association of perithecia and pycnidia in the same locality, (2) the cellular connection of perithecia and pycnidia on the same dead leaf, (3) similar behavior of ascospores and pycnospores in germination and similarity of the two in culture, and (4) positive results yielding leaf spot and pycnidia from inoculation with the ascigerous stage. Roark described the fungus as Mycosphaerella rubi n. sp., but out

of due consideration for Westendorp it should appear as Mycosphaerella rubi (Westendorp) Roark.

Since the time of Berkeley (1874) many agricultural publications have contained brief descriptions of the disease with recommendations for control measures. Such recommendations have been based for the most part on work with other leaf diseases.

In Europe Septoria rubi has been studies mostly in Russia. Potebnia (1910) concluded, on basis of similarity in culture that Rhabdospora rubi Ell. occurring on raspberry canes was identical with the leaf-spot fungus. Jaczewski (1910) considered that the stem form was responsible for considerable injury to raspberries in Russia--a surmise not substantiated by later investigators.

Perhaps the reason for so little attention to the economic aspects of the disease in Europe is found in the fact that the hosts are not of major importance in culture and the disease where present is not usually serious. In this country where the bramble fruits are widely grown, both for commerce and as a garden fruit, the possible economic importance of the disease has naturally received more attention.

NAMES AND SYNONYMS

The name, Septoria rubi, described by Westendorp in his Herbier Crypotgamique Belge (1841-1859) has generally been accepted for the imperfect stage of the fungus. Saccardo (1884) lists as possible synonyms for this stage: Depazea areolata Thumen, Spilosphaeria ruborum Rabenhorst, and Septoria rubi Berkeley and Cooke. These names follow that given by Westendorp by a good many years. Berkeley (1874) collected the fungus on leaves of Rubus in Alabama and gave it the name of Septoria rubi Berkeley and Cooke, perhaps without knowledge of Westendorp's name.

Several varietal names have been added to Septoria rubi Westendorp, but according to recent unpublished work on this fungus by Zeller, strain difference may hardly be sufficient to justify added terminology.

There are few references to fungi which might be the perfect stage of this Septoria. Saccardo (1875) described a fungu under the name Sphaerella ligea and stated that the pycnidial stage was Septoria rubi (Duby) Westendorp. Investigation, according to Roark (1917) shows, however, that the perfect stage found in Wisconsin is not Sphaerella ligea Saccardo. The difference in the size of the ascospores of the two is the basis for this conclusion.

DISTRIBUTION OF THE LEAF-SPOT

Septoria leaf-spot of Rubus occurs throughout the entire temperate zone of the world on both cultivated and wild varieties and species of Rubus. As has been stated, it was first described in Europe in 1841 by Westendorp and reported by other workers since that time. The disease, according to Roark (1917), has been reported in all but seven states of the United States, being more or less prevalent throughout the entire country. In certain years it has been more abundant than in others, doing considerable damage to the cultivated Rubus.

On the Pacific coast it has been observed on practically all cultivated and wild species of Rubus from Canada to Southern California, and especially abundant on the native wild blackberry (Rubus macropetalus). In the Northwest it is especially abundant, but has not been considered a very important economic disease of brambles.

ECONOMIC IMPORTANCE

Although Septoria leaf-spot has not been considered as a disease of general importance, isolated cases have been reported where the disease has done considerable damage. Hesler and Whetzel (1929) reported a 20 percent defoliation of plants in Florida for the year 1905. Anderson (1932) reported that Septoria leaf-spot

(Mycosphaerella rubi) was extremely severe and had practically defoliated all the 1932 canes of Latham raspberry in Southern Illinois. Other reports in various farm journals have indicated a more or less severe occurrence of the disease in other parts of the country.

In the Pacific northwest, the disease perhaps assumes as great importance as anywhere else because of the susceptibility of such of our standard blackberries, as the Loganberry, Himalaya, and Youngberry. Another aspect of the importance of the disease is the fact that it is very prevalent on the wild trailing blackberry (Rubus macropetalus) which is being used quite extensively for stock in breeding work for new horticultural varieties. Since the introduction of the susceptible youngberry and the prevalence of the disease on loganberry (Rubus loganobaccus) in its natural habitat and under cultivated conditions the leaf and cane spot has become increasingly important in our region.

VARIETAL SUSCEPTIBILITY

Septoria leaf-spot has been found on many species and varieties of Rubus, and it is probable that all members of the group are more or less susceptible. Some species are ordinarily more commonly diseased than others but it is not known whether this is due to a well-marked difference in

susceptibility or to variations in the incidence of infection. In the eastern and midwestern part of the United States, among the cultivated species certain blackberries, particularly low-growing types like the dewberry, generally show heavier infection than do raspberries in the field. Among the raspberries there is some evidence that the black raspberry (Rubus occidentalis) is less severely affected than the red raspberry (Rubus strigosus). Mc Clure (1894) considered that the European red raspberry (Rubus idaeus) to be more severely injured than Rubus strigosus. Roark (1917) observed that the dewberry and the smooth-leafed blackberries showed the greatest amount of spotting, while certain black raspberries and Rubus odoratus have been the least affected. He does not attempt to explain these differences.

In the Pacific northwest, according to observations by Zeller, the wild dewberry commonly called trailing blackberry (Rubus macropetalus) seems to be the most seriously affected. Certain cultivated species and varieties of both blackberries and raspberries as well as the western black raspberry (Rubus leucodermis) are severely affected by the disease.

EXPERIMENTS

During the winter of 1932-33 studies were made by the writer under greenhouse conditions to determine the susceptibility of different species and varieties of Rubus to the leaf-spot disease, and also to determine the period of incubation. This was determined by inoculating healthy plants with the fungus and observing the time required for the leaf spots to appear.

Two methods of inoculation were used: (1) by direct contact of an infected leaf with a healthy one, and (2) spraying of a water suspension of spores on healthy leaves.

Inoculation by contact between infected and healthy leaves. The healthy plants to be inoculated were placed in a moist chamber and allowed to remain over night (usually about 12 hours). They were then taken out and infected leaflets from Himalaya blackberry were attached up-side-down on the upper surface of the healthy leaflets by the use of small paper clips. Each infected leaflet was arranged in such a manner that a considerable portion of its surface would be in contact with the leaflet to which it was fastened. The plant was then returned to the chamber and allowed to remain in a moisture-saturated atmosphere for 72 hours to insure sufficient moisture on

the leaf surfaces for germination of the spores. Spore germination tests had previously been run to determine the time for germination. It was found that the spores would germinate in distilled water in from 4 to 6 hours at ordinary room temperature, but the longer period was thought advisable to provide sufficient moisture for the hyphae to penetrate the host tissues. Allowing the plants to remain longer than 72 hours in the moist chamber resulted in the leaves and canes becoming badly infected with molds and so this was the maximum period adopted.

After having remained in the moist chamber the prescribed length of time, the plants were moved to the benches in the greenhouse and observed periodically for the appearance of leaf-spot infections.

Infected leaves collected from the field the same day the inoculations were made and only those showing pycnidia in the spots were used in these tests. Each leaflet had several spots with from one to several pycnidia in each spot.

Uninoculated plants were treated in the same manner as the inoculated ones. Such plants were used for each species and variety and were subjected to the moist chamber treatment as in the case of the inoculated plants. Throughout the tests the plants were thus paired, so that

each of the plants was as nearly identical as to variety and stage of maturity as was possible to obtain.

Plants used in the inoculation studies by this method included the following blackberries: Himalaya (a variety of Rubus procerus), Loganberry (Rubus loganobaccus), Wild Trailing (Rubus macropetalus), the selection of it known as "Ideal Wild", and the varieties Brainard, Youngberry and Lucretia. The Cuthbert variety of the red raspberry was also inoculated.

Inoculation by spraying spore suspension on healthy leaves. Procedure for this series of inoculations was similar to that used above. The healthy plants were placed in the moist chamber for 12 hours previous to inoculation and for 72 hours after inoculation. Inoculations were accomplished by spraying a water suspension of spores over the foliage of the healthy plants.

The material used for the inoculations was from infected leaves of the Himalaya blackberry. Only leaflets whose spots showed the presence of pycnidia were used. These were brought into the laboratory and macerated in water in a mortar. The macerated material was then poured into another container and allowed to remain in the ice-box over night. This was done to permit a thorough diffusion

of spores throughout the liquid portion of the material. A drop of the spore material was examined microscopically for the presence of spores, which were found in abundance in every instance before inoculations were made.

Then without filtering or straining the suspension it was sprayed on the foliage of the plants with a small hand atomizer. Each plant was thoroughly sprayed on both upper and lower surfaces of the leaves, then replaced in the moist chamber for the prescribed length of time (72 hours) before being placed on the benches in the greenhouse to await development of the leaf spots. In this series the plants of each variety were paired as for the previous series of inoculations already described, one of each being used as an uninoculated check.

Blackberry plants inoculated in this series were Himalaya (a variety of Rubus procerus), Loganberry (Rubus loganobaccus), Ideal Wild (a selection of Rubus macropetalus), and the varieties, Brainard, Youngberry and Lucretia. The black raspberries included the western black cap (Rubus leucodermis) and Plum Farmer (a variety of Rubus occidentalis) while the red raspberry varieties inoculated included the Chief, Cuthbert and Latham.

Another set of inoculations in this series was run, using the same methods as just described, except that

the plants were not placed in the moist chamber either before or after inoculation. The object of these tests was to determine the part that moisture played in the germination of the spores and the penetration of the host tissues by the hyphae of the fungus, These inoculations served as a check on the series in which the plants were subjected to conditions in the moist-chmaber. Plants used for inoculation in this set included Himalaya, Ideal Wild, and Lucretia.

RESULTS OF INOCULATIONS

In the experiments where inoculation consisted of contact between infected and healthy leaves the first inoculations were made on February 3, 1933, after the leaflets had reached about half maturity. About one-half of the leaves of each plant were inoculated at this time.

Six infected leaflets were attached to as many leaflets of the Youngberry and Lucretia and 4 each to Loganberry and Cuthbert leaflets. The first appearance of spotting was observed to occur on the leaflets of the Lucretia variety on March 6th. On the 8th there was evidence of spotting on the Loganberry and on the 10th spots were found on the Youngberry and a doubtful spot was found on a dead inoculated leaf of the Cuthbert raspberry. Results of the inoculations are given in Table I.

TABLE I Presenting the results of inoculations of *Septoria rubi* by contact between infected and healthy leaves of several varieties or species of Rubus conducted in the greenhouse, February 3rd, 1933.

Species or Variety	Number of leaves inoculated	Number of leaves infected	Date spots first appeared	Incubation period (days)
Loganberry (inoculated)	4	1	3-8-33	33
Loganberry (uninoculated)	--	--	None	
Cuthbert (inoculated)	4	1[a]	3-10-33	35
Cuthbert (uninoculated)	--	--	None	
Lucretia (inoculated)	6	3	3-6-33	31
Lucretia (uninoculated)	--	--	None	
Youngberry (inoculated)	6	1	3-10-33	35
Youngberry (uninoculated)	--	--	None	

a- This leaf had died and turned brown, but there were several spots with small fruiting bodies in each spot on it.

It will be seen from Table I that with the exception of the Lucretia, a very small percentage of infection took place. It is thought that this was due to lack of moisture, because in every instance the leaves that did show spotting were near the lower part of the plant where the infection may have been influenced by the moisture in the soil. The period of incubation, which proved to be somewhat over a month, would also indicate that there was an insufficient amount of moisture to allow a rapid increase in the development of the mycelium of the parasite.

Roark (1917) in his inoculation studies gave the period of incubation as from 8 to 11 days, although wider variations occurred. He also states that in the field the greater amount of infection occurred after a rain with a corresponding decrease in temperature.

In the writer's inoculation experiments, it would seem that temperature was also an important factor in the degree of infection and the period of incubation. Roark found in his temperature studies of the spores of Septoria rubi that the optimal temperature was 23° C with a range from 18° to 32° C, tested by spore germination in a drop of distilled water. If this is the case, then, the temperature during the writer's experiments probably

ranged above the optimum and near the maximum at which germination would result. This higher temperature with a corresponding decrease in the amount of moisture present was in all probability an inhibiting factor for infection.

That the temperature in the greenhouse was unfavorable for abundant infection is again suggested by the fact that under field conditions in Oregon it is known that infection from the spores usually takes place during the spring of the year after the new leaves begin to unfold, and during the time when there is an abundance of rainfall with relatively low temperatures.

On February 23, 1933, a second series of inoculations were made in the same manner as described above. More plants were used, however, and for the most part the plants had more foliage. The blackberry plants used in this series included the Wild Trailing, Ideal Wild, Loganberry, Himalaya and the Brainard. The Cuthbert variety of red raspberry was also used.

In this series it was observed that there was a slight increase in the percentage of infection and also a slight decrease in the period of incubation. The results of the inoculations are shown in Table II.

TABLE II Presenting the results of inoculations of *Septoria rubi* by contact between infected and healthy leaves of several varieties or species of Rubus conducted in the greenhouse, February 23, 1933.

Species or Variety	Number of leaves inoculated	Number of leaves infected	Date spots first appeared	Incubation period (days)
Wild Trailing Blackberry (inoculated)	5	4	3-13-33	18
Wild Trailing Blackberry (uninoculated)	--	--	None	
Loganberry (inoculated)	10	5	3-16-33	21
Loganberry (uninoculated)	--	--	None	
Himalaya (inoculated)	5	4	3-14-33	19
Himalaya (uninoculated)	--	--	None	
Cuthbert (inoculated)	5	0	None	
Cuthbert (uninoculated)	--	--	None	
Brainard (inoculated)	5	2	3-10-33	15
Brainard (uninoculated)	--	--	None	
Ideal Wild (inoculated)	6	5	3-12-33	17
Ideal Wild (uninoculated)	--	--	None	

The shortest time observed was in the case of the Brainard which was 15 days and the longest in the Loganberry which showed no spotting until the end of 21 days. Temperature conditions were practically the same as in previous inoculations. It might be thought, however, that since the plants were growing more rapidly by this time and had more foliage than at the time of the first inoculation the additional foliage might have prevented rapid air circulation and thus allowed a higher moisture condition to prevail around the plants, especially around the lower leaves. Later experiments do not bear this out, as will be shown.

The first series of inoculations where suspensions of spores in water were sprayed on healthy leaves were made on March 7, 1933. The plants used included the red raspberry variety, Chief, the Western black-cap (R. leucodermis) and the black raspberry variety, Plum Farmer.

The source of inoculum was the same as for all previous inoculations, being from the infected leaves of the Himalaya blackberry. The tests indicate that the strain of Septoria used by the writer is not narrowly restricted in its host relationships, since this strain from the blackberry was able to cause infection on both the red and black raspberry.

TABLE III Presenting the results of inoculation by spraying spore suspension on healthy leaves, March 7, 1933.

Species or Variety	Result (a)	Date spots first appeared	Incubation period (days)
Plum Farmer (inoculated)	x-	4-6-33	30
Plum Farmer (uninoculated)	--	None	
R. leucodermis (inoculated)	x-	4-6-33	30
R. leucodermis (uninoculated)	--	None	
Chief (inoculated)	xxx	4-2-33	26
Chief (uninoculated)	--	None	

(a)
xxx Numerous leaves spotted
xx A moderate number of leaves spotted
x- Few leaves spotted
-- No leaves spotted

There was considerably more leaf spotting resulting from this method of inoculation as compared with the direct contact method of spore transfer. This is probably due to the fact that more inoculum was used and that more leaf surface was exposed to the infecting material. The period of incubation was not decreased as the minimum time, in the case of the Chief variety, was 26 days while the maximum on Plum Farmer and R. leucodermis was 30 days. There seemed to be a greater amount of infection on the lower leaves than on the higher ones. This again would indicate that moisture was an important factor in the germination of the spores and penetration of the hypae of the leaf-spotting fungus.

It will be noted that the plants used in this series of inoculations were all raspberries, the western black -cap (R. leucodermis), Plum Farmer black raspberries and the red raspberry variety Chief. In all these plants infection was successful, especially on the variety Chief which showed considerable spotting. This would seem to indicate that there was no marked differentiation in susceptibility among the black and red raspberries as a whole, although the Cuthbert variety of red raspberry has remained immune throughout all these experiments.

On March 10th another series of spray inoculations

was made, using a greater number of varieties of Rubus. The plants used included: the "Ideal Wild" (R. macropetalus), the blackberry varieties Lucretia and Brainard, the varieties Chief and Latham of the red raspberries and Plum Farmer and R. leucodermis of the black raspberries. The Himalaya blackberry was also used.

In the series of inoculations of March 10, varieties and species known to be susceptible to the Septoria leaf-spot were used. Infection was successful in all cases, the severity of infection varying with the species or individual plant. The Latham raspberry was less severely infected than any of the blackberry varieties. The incubation period remained practically the same as in previous inoculations, the minimum being 25 days for Lucretia and 29 days for the Latham raspberry as the maximum. The results of this series are shown in Table IV.

TABLE IV Presenting the results of inoculation by spraying spore suspension on healthy leaves, March 10,1933.

Species or Variety	Result	Date spots first appeared	Incubation period (days)
Ideal Wild (inoculated)	xxx	4-7-33	28
Ideal Wild (Inoculated)	xx	4-6-33	27
Ideal Wild (uninoculated)	--	None	
Lucretia (inoculated)	xxx	4-6-33	27
Lucretia (uninoculated)	--	None	
Latham (inoculated)	x-	4-8-33	29
Latham (uninoculated)	--	None	
Brainard (inoculated)	xx	4-7-33	28
Brainard (uninoculated)	--	None	
Lucretia (inoculated)	xxx	4-4-33	25
Lucretia (uninoculated)	--	None	
Himalaya (inoculated)	xxx	4-6-33	27
Himalaya (uninoculated)	--	None	
R. leucodermis (inoculated)	x-	4-6-33	27
R. leucodermis (uninoculated)	--	None	
Chief (inoculated)	xx	4-7-33	28
Chief (uninoculated)	--	None	
Plum Farmer (inoculated)	xx	4-6-33	27
Plum Farmer (uninoculated)	--	None	

xxx Numerous leaves spotted
xx A moderate proportion of the leaves spotted
x- Few leaves spotted
-- No infection

Another set of atomizer inoculations was made on March 16, 1933, upon three varieties that have always been referred to as being extremely susceptible, namely: Himalaya, Ideal Wild and Lucretia blackberries. The purpose of this was to determine if possible whether infection would take place without the use of the moist chamber either before or after inoculation. This also served as a further check on the spray inoculation method as the technique used was identical to that described previously.

The results of the inoculations are shown in Table V. No infection appeared on any of the plants, although kept under observation for 40 days following inoculation. It would seem, then, that under the conditions to which the plants were subjected in the greenhouse there was an insufficient amount of moisture to allow germination of the spores or, at least, successful penetration of the germ tube without the use of some artificial means of providing more moisture.

TABLE V Presenting the results of inoculation by spraying spore suspension on healthy leaves, March 16, 1933. Plants not subjected to moist chamber treatment either before or after inoculation.

Species or Variety	Result	Date spots first appeared
Himalaya (inoculated)	None	--
Himalaya (uninoculated)	None	--
Ideal Wild (inoculated)	?	4-20-33
Ideal Wild (uninoculated)	None	--
Lucretia (inoculated)	None	--
Lucretia (uninoculated)	None	--

(?)
In the case of the Ideal Wild, one leaflet showed a few spots on April 20th. These spots, however, were not typical nor did they contain pycnidia.

SUSCEPTIBILITY

From the experiments conducted by the writer and those of other previous workers it has been observed that the severity of infection by the leaf-spot disease varies with the species and varieties of Rubus. Whether this is due to differences in strains of the organism in question, as suggested by Roark (1917), or in the natural immunity of the species or variety of the plant, the writer does not attempt to answer. It is thought, however, since there were more marked differences in the number of infections between species or varieties than was exhibited by individual plants within the same species or variety, that some measurement should be made of these differences.

The method adopted for comparing the number of leaf-spots per unit leaf area occurring on comparable plants of different species and varieties was briefly as follows:

The plants used for this comparison had received essentially the same treatment, that is, each plant had been sprayed at the same time with the spore suspension from the same source and had been kept under identical greenhouse conditions both before and after the inoculation. Five leaflets that were considered representative as to

size and as to number of leaf spots were removed on May 9 from each plant which had been inoculated by the spray method on February 10, 1933. The area of each leaflet was measured by means of a planimeter and the number of spots were counted. The areas and the numbers of spots were then averaged, thus giving the average number of spots per representative leaflet. The number of spots was then divided by the leaf area to give the number of spots per unit of leaf area. These data are given in Table VI.

Plants used for these comparisons included Himalaya, Brainard, Ideal Wild and Lucretia of the blackberries, the varieties Chief and Latham of the red raspberries and the variety Plum Farmer and the Western Black Cap of the black raspberries.

It will be seen in Table VI that there was a marked degree of difference in the amount of infection shown among the different varieties. Of the blackberries, the Ideal Wild and Himalaya had the most leaf-spots per unit area while the varieties Brainard and Lucretia showed a considerably smaller amount. Of the raspberries the amount of infection was much less than that shown for either the Himalaya or Ideal Wild, but in the Latham red raspberry and the Plum Farmer black raspberry there was more infection per unit leaf area than was found on either

the Lucretia or Brainard blackberries.

A comparison of the red raspberry with the black raspberry does not show an appreciable difference between the varieties used in this test.

TABLE VI The relative number of leaf-spot infections on the several varieties of Rubus inoculated in the greenhouse, February 10th, 1933.

Species or Variety	Average leaf area in square inches	Average number of spots per leaf	Average number of spots per square inch of leaf surface
Himalaya	3.03	25.	8.2
Ideal Wild	1.26	28.	22.2
Plum Farmer	1.2	9.3	7.75
Latham	1.4	8.	5.71
Brainard	1.16	7.	6.3
Lucretia	1.23	5.	4.6
Chief	2.53	3.6	1.4
R. leucodermis	1.96	3.3	1.6

CONCLUSION AND SUMMARY

In review of the work of Roark and others, from conversations with Dr. S. M. Zeller and Prof. C. E. Owens regarding the Septoria leaf-spot disease, and from the results of experiments by the writer, it would appear that there remains considerably more work to be done on the susceptibility of varieties and species of Rubus to the disease.

This should perhaps be emphasized because of the importance placed on some of the commercial varieties of Rubus grown in this locality, which under field conditions are usually badly infected with the leaf-spot. In the past it has been considered that wherever the leaf-spot is found, it is usually quite common but rarely serious. The chief damage done is brought about by the early defoliation, which inhibits normal bud development and generally devitalizes the plant. In view of this fact and the importance placed on our cultivated varieties and native species that are considered highly susceptible to the disease, it would seem that some study on a control method should be attempted.

As far as the writer has been able to ascertain, there has been no estimate on the amount of damage caused

yearly to the bramble plantings in this locality by the Septoria disease. That there is some loss, can hardly be denied, but whether it is enough to compensate any effort towards control has not been the purpose of the writer to determine.

In this paper the evidence that is brought out seems to corroborate to some extent the findings of previous workers that there is greater susceptibility exhibited by certain species and varieties than by others.

The paper is summarized as follows:

1. From the results of experiments there appears to be a difference in the susceptibility of certain species and varieties of Rubus to the Septoria leaf-spot disease.

2. All of the species and varieties of Rubus tested by the writer, with the exception of the Cuthbert red raspberry, proved susceptible to a greater or less degree.

3. The average period of incubation of the disease was several days longer than that given by previous workers. The minimum was 15 days and the maximum 35 days.

4. Differences in strains of the causal fungus were not apparent, the material used in these tests having been taken from a single source only.

5. The Himalaya, Ideal Wild and Wild Trailing blackberries showed the greatest amount of infection while Lucretia showed the least. The raspberries showed much less infection than the blackberries. The Cuthbert red raspberry showed no trace of infection while the Latham and Chief were moderately infected. There was little difference exhibited in the amount of infection shown by red and black raspberries included in these tests.

LITERATURE CITED

Anderson, H. W.

1932. Plant Dis. Rept. XVI: Nov. 15.

Berkeley, M. J.[a]

1874. Notices of North American fungi Grev. 3: 1-17.

Hesler, L. R. and H. H. Whetzel

1929. Manual of Fruit Diseases. The MacMillan Company, New York

Jaczewski, A. A.[a]

1912. Annual report of diseases and injuries of cultivated and wild grown useful plants in 1910. Bur. Mycol. and Phytopath. of the Sci. Comm. 6:1-474

McClure, G. W.

1894. Blackberries and raspberries, variety tests and management. III Illinois Agr. Exp. Sta. Bul. 50.

Potebnia, A.[a]

1910. Beiträge zur Micromycetonflora Mittel-Russlands. Ann. Mycol. 8: 42-93.

Roark, E. W.

1921. The Septoria Leaf-spot of Rubus. Phytopath. 11:328-333. Aug.

Saccardo, P. A.[a]

1882. Sylloge fungorum, v. 1. Patavii.

_____

1896. Sylloge fungorum, v. 3, Patavii.

Westendorp, G. D.

1841-1859. Herbier cryptogamique belge.

(a) Literature was abstracted by Dr. S. M. Zeller.