The Barberry and its Relation to the Stem Rust of Wheat in Indiana.

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It has now been over 250 years since the European farmers began to observe that the common barberry bush (*Berberis vulgaris*) had harmful effects upon the grain fields, particularly those of wheat, through severe rusting of the straw, and causing considerable shriveling of the grain. As early as 1660 a law was passed against it in the district of Rouen, France.[1] In later years, as the barberry was introduced into other European countries, frequent complaints were made by the farmers that the bush was responsible for a great deal of injury to the grain growing in its vicinity. One writer (Djörup[2]) remarks in this connection: "Many of the inhabitants reaped only straw, which, of course, could not be thrashed." In many instances the barberries were eradicated, either voluntarily or through force of law, or by the injured farmers themselves. There was no consensus of opinion, however, as to the guilt or the innocence of the barberry, and, as Lind relates in his article, a rather dramatic war was waged over the question. In 1863 DeBary finally demonstrated, through cross-inoculations, that one stage (*aecial*) of the stem rust of wheat (*Puccinia graminis*) passed its life on the leaves of the barberries. Even after this discovery, however, it was not agreed that the barberry was in any way responsible for the rust infection, and not until about thirty years ago was this fact generally accepted by the botanical profession.

During the seventeenth century the barberry was introduced into America, where it is now used extensively as an ornamental shrub. It is of interest to note that a law was passed against it in Connecticut in 1726, and in Massachusetts in 1755. It is doubtful, however, if the laws were ever enforced.

Owing to a lack of definite information regarding the extent to which the common barberry and its purple-leaved variety were responsible for the stem rust infection in this country, no special effort was made heretofore to bring about the eradication of this shrub. The great World War and the urgent need of food presented an opportunity to bring up the question of the eradication of the barberry, which, it was believed, would reduce stem rust infection and save millions of bushels of valu-

[1] J. Lind, Berberisbusken, og Berberisloven. Denmark, 1915.

[2] Quoted in Lind's article. See note [1].

able grains. The agitation of this question, enlivened by the fact that a very severe rust infection in 1916 caused a loss of over 200,000,000 bushels of wheat, resulted in the present barberry eradication campaign, comprising the upper Mississippi and the Western States, with Montana as the western and Ohio as the eastern limits. The campaign is conducted by the Office of Cereal Investigations, of the United States Department of Agriculture, in co-operation with the State Agricultural Colleges.

The barberry has been introduced into Indiana probably during the second half of the nineteenth century. Bushes have been found in the State which the owners claim to be over fifty years old. Most of the plantings, however, are of a more recent origin. The barberry scouts, who made a careful survey last spring and summer of the cities and larger towns in the northern thirty-six counties, located approximately 1,500 plantings. It is estimated that there are not less than 3,000 plantings within the State. The barberries are not so numerous in the counties south of the Indianapolis line, especially in the extreme southern end of the State, where they are very rare. Some of these plantings were very extensive, each containing several hundred bushes. Along the main line of the Pennsylvania Railroad, running from Chicago to Columbus, Ohio, there was a planting at nearly every station. Some were hedges several hundred to 1,000 feet long. At Valparaiso, Anderson and other cities large lots and even whole city squares were surrounded by barberry hedges. The country districts seem to be comparatively free from barberries, so far as can be judged from general observations. Several communities have been found, however, where bushes were growing on the farms and playing a very important role, as will be pointed out later, in starting local rust epidemics.

The earliest recorded mention of wheat rust causing serious injury in Indiana is found in the annual report of the Indiana State Board of Agriculture for 1868, pp. 364-365, in which Professor R. S. Brown, in discussing this disease and its control, makes this statement: "Cultivating early varieties of wheat, and immediately cutting, if the rust strikes the straw, are the only remedies we have to propose for this evil, which so often blasts, in a night, the brightest prospects of the farmer." The rust collection of the Department of Botany, Purdue University Agricultural Experiment Station, contains specimens of wheat stem rust from nearly every section of the State.

In 1892 Dr. Arthur[3] reported the following observation: "At one edge of a field of wheat on the Experiment Station farm at Lafayette, Indiana, were many large barberry bushes, forming a thicket some twenty-five by fifty feet. The season was favorable to the production

[3] Proc. Soc. Prom. Agric. Sci. 23d Ann. Rep.

of rust, and the barberry bushes were all covered with aecidia. By the first week in July the wheat field was also well rusted. * * *"

The survey made last summer in the northern part of the State and in a few districts of the southern part showed that prevalence of the stem rust of wheat followed closely the distribution of the barberries. In sections having large numbers of barberry bushes there was a comparatively heavy rust infection, while in sections where no barberries were found little or no rust was observed. In every instance where a severe rust infection was reported and investigated there was no difficulty in locating barberry bushes in the immediate or near vicinity of the damaged fields.

The following specific cases, investigated last summer, are presented to show the guilt of the barberry in spreading the stem rust of wheat in Indiana:

Case 1. Franklin County. A barberry bush was growing in the yard of Ed. Heap's farm near Drewersburg. Another bush was growing in the corner of a field across the road from the house. Mr. Heap's and two of his neighbors' wheat fields were very heavily rusted. The grain from these fields was refused by the local dealers as being worthless for milling purposes, and the County Agricultural Agent had to obtain a special permission from the County Food Administrator to allow the farmers to feed this grain to their stock. It was very noticeable in this case that practically all infection took place on the windward side of the barberries.

Case 2. Franklin County. Several barberries were found on the farm of Bradbury Hudson, several miles from Brookville. Other bushes are said to be growing in this neighborhood. All wheat in this community was reported by Mr. Hudson to be badly rusted.

Case 3. St. Joseph County. The following paragraph appears in the annual report, for 1918, of the Agricultural County Agent, J. S. Bordner: "In 1915 an urgent request came from Madison Township to come to the farm of Jonas Loucks, where an entire field of wheat had been ruined by some disease. Investigation showed the most pronounced attack of black rust which the writer had ever seen. Additional investigation showed infection in other fields, but not as pronounced, because most of the wheat of the neighborhood matured from four to ten days earlier than this particular field. Damage from red and black rust has been found each season in this community. This year an organized effort was made to locate the source of infection. The accompanying cuts speak for themselves. The barberry was found red-handed. One barberry hedge several rods in length has been responsible for the presence of rust in the entire surrounding country, the actual damage ranging from 2% to 50%, the field adjoining the barberry hedge sus-

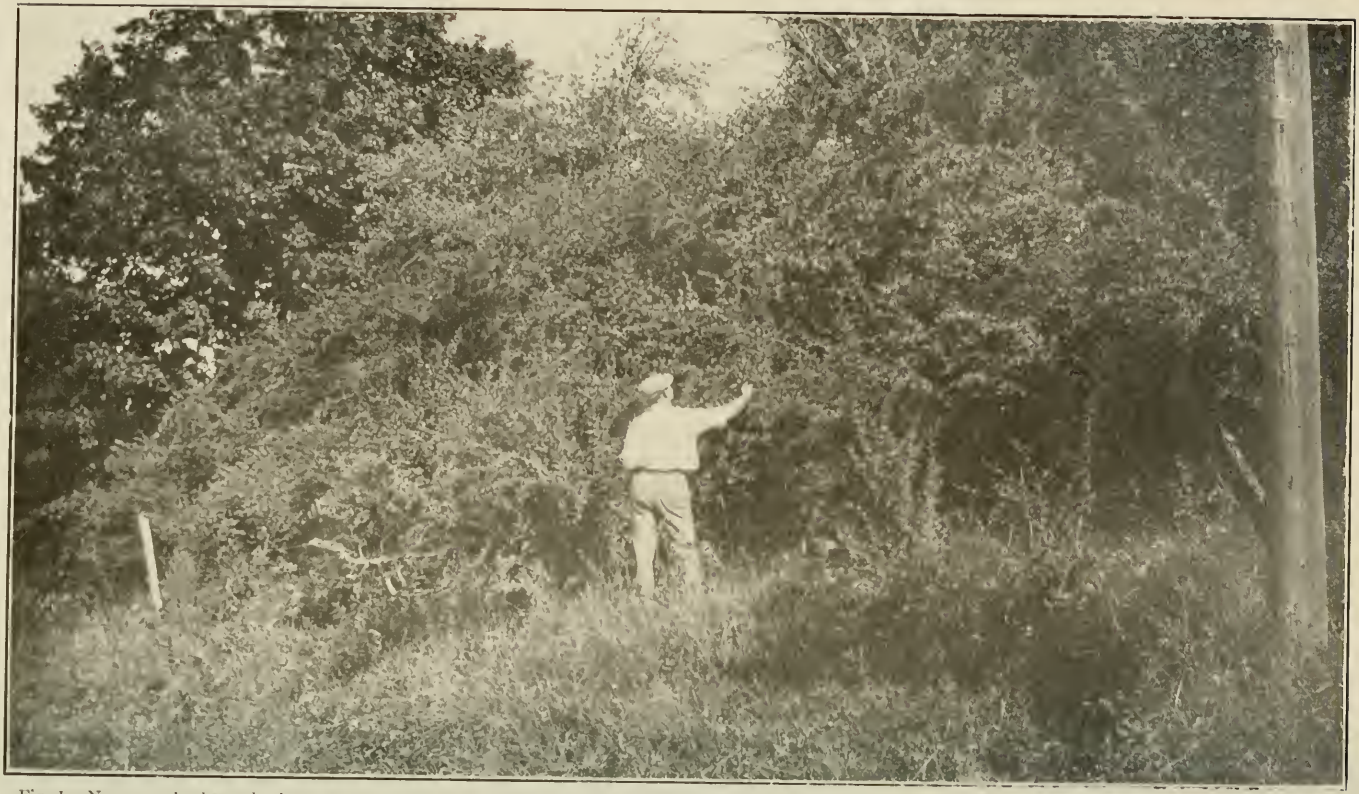

Fig. 1. Numerous barberry bushes covering a hillside in Wabash County. There bushes were responsible for a severe rust infection in the wheat field shown in Fig. 2. Read Case 13.

Fig. 2. The wheat field referred to under Fig. 1. The barberries are just across the road from the field, directly below the orchard.

taining the greatest loss." Infected barberry leaves were found when the field was inspected.

Case 4. St. Joseph County. Mr. Bordner also reports the following: "Another striking case of damage was found in the field of Charles Bunch near Lakeville, and upon thorough investigation we found barberry in the neighbor's back yard some ten rods away."

Case 5. Wayne County. A few miles east of Centerville stands a country church with a cemetery about eighteen rods from the building. A barberry hedge is growing on both sides of the walk leading from the church to the cemetery. Within a radius of about one-half of a mile from this hedge, especially on the windward side, all wheat fields were badly rusted. In the nearest field, on the McConaha farm, a prospective yield of thirty bushels of wheat to the acre was reduced to less than ten bushels.

Case 6. Wayne County. W. O. Seoney, Boston Township, suffered considerable losses from wheat rust for many years. A couple of years ago the crop was nearly ruined. Mr. Seoney wrote to the Agricultural Experiment Station and asked for a specialist to examine the crop and determine, if possible, the cause of the trouble. When the investigator found that the unusually heavy infection was due to the stem rust he searched the vicinity for barberry bushes and found a large one twenty rods from the wheat field. The bush was immediately removed. Last year Mr. Seoney's wheat was free from rust for the first time in many years, although a very heavy infection occurred in another section of the county not far from his farm.

Case 7. Jasper County. A barberry hedge was found on a farm two and a half miles north of Rensselaer. A wheat field across the road was heavily rusted. (Reported by W. E. Leer.)

Case 8. Rush County. The stem rust practically ruined the wheat crop in Orange Township on the farms of Jos. Brown, John Douthett, Chas. Owens and several others belonging to the same threshing ring. In one case the crop was a complete loss, as the grain did not even have any value as a stock feed. An investigation of the trouble resulted in locating an old abandoned nursery on a farm in the center of the affected community. Many barberry bushes formerly grew on this farm, but were dug up, as claimed by the owner, a couple of years ago. A further inquiry, however, disclosed the fact that a number of bushes were growing along the border of the farm woodlot which were not removed until last summer, after rust infection had already taken place. It is probable that there are other bushes growing wild in this community which have come up from seeds scattered by birds.

Case 9. Rush County. Two very severe cases of stem rust infection were found on the farms of T. A. Coleman and Wm. Garten, situ-

ated about two and a half miles northeast of Rushville. A careful search of the community resulted in locating a twelve-foot hedge of barberry bushes, most of which were over ten feet high. The infected fields were about three-quarters of a mile in direct line of the prevailing wind from the barberries.

Case 10. Jefferson County. A barberry hedge and several group plantings were found, late in the fall, about one and a half miles northeast of Madison. When the relation of the barberry to the stem rust of wheat was explained to one of the owners she recalled that a severe rust infection occurred last summer in a wheat field across the road from the barberries.

Case 11. Wabash County. Six infected barberries were found on the grounds of the Children's and Orphans' Home, three miles south of Wabash. Just across the fence from them was a wheat field in which the crop was badly rusted. (Reported by W. E. Leer.)

Case 12. An old planting of six large and several small barberry bushes was found on a farm eight miles southwest of North Manchester. The older bushes were about fifteen feet high, with stems several inches in diameter. A considerable rust infection was observed in wheat fields in this community within a radius of nearly two miles, especially in the windward direction. A field of oats and another of rye, about a quarter of a mile from the barberries, were also heavily rusted. (Reported by W. E. Leer.)

Case 13. Wabash County. A severe case of stem rust infection was reported by Nathan Gilbert on his farm five miles southwest of Wabash. Upon investigation it was found that numerous barberry bushes covered a hillside just across the road from the wheat field in question (see Fig. 2). The bushes showed abundant infection of the aecial stage of the rust. The entire wheat field was heavily infected, especially within a distance of about 100 feet of the road, where the grain was black with rust. Another wheat field situated about three-quarters of a mile from the barberries also had a considerable infection, but much less severe than the nearer field. The prospective yield of the first field was reduced by at least 60 per cent. A number of local farmers held a meeting at this field to see the havoc wrought by the barberries. The guilt of the bush was so firmly established in their minds that they went on record with the following resolution:

> We, the undersigned farmers of Wabash County, Indiana, at a meeting at the farm of Nathan Gilbert in Noble Township on July 19, 1918, called for the purpose of observing the ravages of the black stem wheat rust on the seventeen-acre wheat field, desire to go on record as follows:

1. We are fully convinced, after making these observations, that there is a connection between the common barberry and the black stem wheat rust. On the south side of this ruined field is a large planting of common barberry bushes, which have been badly infested by the rust. We have observed that the rust started on the side of the field next to these bushes and that now the worst infestation is on the side nearest the barberries.

2. We desire to go on record as favoring any legislation looking toward the complete eradication of the common barberry bush, believing it to be of no value, but on the other hand a serious menace to the wheat-growing industry.

(Signed)

NATHAN GILBERT.	JOHN SHAMBAUGH.
N. L. GILBERT.	H. H. BEHNY.
DAVID FLORA.	L. R. MILLER.
R. D. FLORA.	W. CURTIS.
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DAN COOPER.	JACOB STAUFFER.
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