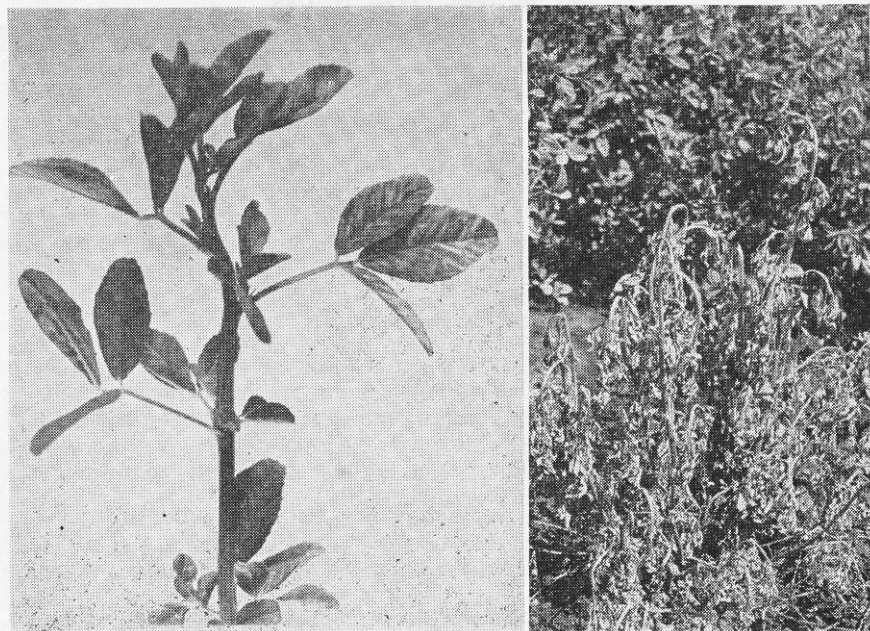


# Four Important Diseases of Sweet Clover

By W. E. Brentzel<sup>1</sup>

The sweet clover plant has several destructive diseases. Producers have complained of losses from "seedling blights" and from several kinds of crown rotting of older plants, especially in the second year's growth. Producers in the corn belt states and in this state often have requested information on control measures for these troubles.

Although several diseases have been observed during the course of this work at least one important insect, the sweet clover weevil, has been observed as the cause of much damage to plants in the early stages of development. It is believed now that on many occasions growers have mistaken the work of this insect for that of some destructive seedling disease. Failure to obtain a stand, or the loss of a good stand of plants in the early season of the first year, often is caused by the sweet clover weevil. However, there are more than a dozen known fungus diseases and a number of virus diseases which may attack the sweet clover plant. Only a few diseases, those that are common and destructive in this region, will be included in this report.



**Fig. 1.** Plant at left is affected with the virus disease of sweet clover. Note yellow chlorotic streaks or spots on the leaves. Right, an example of fusarium root rot of sweet clover. The smaller, wilted plant in the foreground is affected.

<sup>1</sup>Plant Pathologist.

## Root Rot

Two common types of root rot are known to occur in North Dakota. The most destructive disease of sweet clover observed during the last few years was a root rot disease caused by the fungus *Fusarium*. The fungus closely resembles *F. solani*<sup>1</sup>, produces a type of wilting, and a severe crown rotting, as is characteristic of this kind of fungus disease (Fig. 1). After the fungus has run its course the tap roots are left almost completely disintegrated and the affected plants can easily be lifted from the soil by pulling. When this stage of development is reached, the fungus becomes elusive and very difficult to isolate from the plants. But it was isolated without difficulty when wilting first set in.

In 1949 the first signs of wilting appeared June 21 on a single plant of the variety Sangamon. A slight wilting of the upper tips of the plant was noticed. The wilting developed rapidly, soon affecting the whole plant. Within a week the plant was dead and the disease began to appear on other plants. By July 20 the wilting was found on several varieties in the nursery. The extent of wilting in the different varieties was determined and recorded as shown in the following table.

**Table 1.** PER CENT OF SWEET CLOVER PLANTS OF DIFFERENT VARIETIES AFFECTED BY FUSARIUM WILT IN THE FIRST AND THE SECOND YEAR STAGE OF DEVELOPMENT.

July 20, 1949, Fargo, N. Dak.

Variety	Flower color	Per cent wilt, plants in 1st and 2nd year stage	
		1st year	2nd year
Albortrea.....	yellow	0	12
Madrid.....	"	2	20
Redfield.....	"	0	..
Erector.....	"	0	6
Golden*.....	"	2	..
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Spanish (13272).....	white	0	12
Alpha.....	"	0	20
Willamette.....	"	2	10
Pioneer.....	"	8	80
Evergreen.....	"	0	10
Sangamon.....	"	2	20
Spanish (31,759).....	"	0	10
Arctic.....	"	0	4
Iowa Late.....	"	0	..
Wisc. Late.....	"	0	..
Brandon Dwarf.....	"	0	4
Melana*.....	"	0	..
Hubam*.....	"	0	..
Emerald*.....	"	0	..

\*Annual.

<sup>1</sup>Said to have frost resistance.

Several varieties seem to be susceptible, especially the variety Pioneer. This variety is a low-cumarin (less bitter tasting) strain of white sweet clover from Canada. The other varieties which failed to wilt in this single test may be more or less resistant to wilt. However, the last 10

<sup>1</sup>The author is indebted to Dr. W. L. Gordon, Uni. of Man. for examining a culture of this fungus and verifying its identity as *Fusarium solani*.

varieties were growing on somewhat higher ground and this might have been less favorable for the wilt disease. It appears quite certain that wet soil favors *Fusarium* wilt and root rot of sweet clover.

Another kind of root rot is brought on by the fungus *Cylindrocarpon*. This fungus often has been classified and included in the genus *Fusarium* which it resembles, until it was separated and given the new name, *Cylindrocarpon*, by Wollenweber<sup>1</sup> At least three species have been found to cause root trouble on sweet clover. *C. Ehrenbergi* is considered one of the most important of the three and has been reported as the cause of considerable damage on older plants in early spring.

This type of root rot resembles *Fusarium* root rot but it begins developing much earlier in the spring. Infection of the roots starts as soon as the frozen ground begins to thaw in the spring and it develops rapidly until the soil warms up, after which the fungus seems to disappear. The large tap roots of sweet clover are first attacked near the soil level after which the infection soon works down into the other roots and also up the stem to a slight degree. The roots become dark brown in color and completely decay within a few weeks. At the end of its period of destruction the fungus develops into a resting stage, forming hard knots, sclerotia-like masses, on the sweet clover roots. The sclerotia may be more or less salmon colored but the color is not always the same.

In 1949 another species of this fungus, *C. radicola* was causing some trouble at Fargo. The fungus was isolated from the roots of sweet clover after the affected plants were wilting and turning yellow<sup>2</sup>. This species of the fungus *Cylindrocarpon* has not often been known to cause damage in North Dakota.

Research has not advanced far enough to fully develop control measures. But since only a few sweet clover varieties in the nursery became infected, there is hope that some of the varieties may possess a measure of resistance.

### Black-Stem Disease

A black-stem disease on sweet clover caused by the fungus *Ascochyta* sp. has been observed regularly each year since 1940. On sweet clover this fungus rarely has developed pycnidia (spores) during the growing season but the over-wintering stage of the fungus (known as *Mycosphaerella*) may be found readily in the fall.

There is some evidence that this disease may be transmitted by the seed,<sup>3</sup> or it may spread from stem to stem and plant to plant by means of spores, after the fungus becomes established.

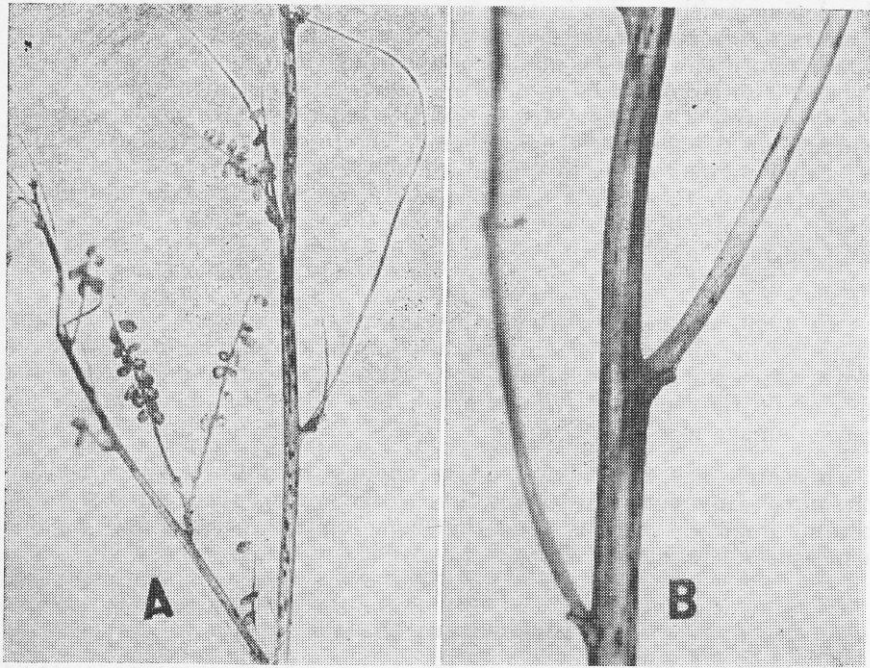
<sup>1</sup>Wollenweber, H. W., *Ramularia Mycosphaerella, Nectria, Colonectria, Eine morphologisch Studie zur Abgrenzung von Pilzgruppen mit Cylindrischen und stielformigen Konidienformun.* Phytopath. 2:197-241. 1913.

<sup>2</sup>A transfer of this culture was sent to Dr. M. W. Cormack, Dom. Lab. of Plant Pathology, Alberta, Canada, who identified it as similar to the species reported on the roots of sweet clover in Alberta.

<sup>3</sup>Jones, F. R., Four fungus parasites of sweet clover infecting seed. Phytopath. 29:313. 1939.

The black discoloration of stems is not caused only by this fungus but perhaps also by other fungi or by chilling temperatures in the late fall. A black-stem disease of alfalfa, which has been observed on several occasions, is caused by the fungus *Phoma* sp. The fungus *Phoma* has been isolated also from black-stem lesions on red clover.<sup>1</sup>

The black-stem disease may attack plants less than one year old but more often the greatest amount of damage occurs during the second year. When the black spots appear only on the larger woody stems the damage is of little importance. On some varieties the infection may spread to the small stems which bear leaves, flowers or seed. When this condition develops the damage may be considerable (Fig. 2).



**Fig. 2. Black stem disease of sweet clover. (A) Small stems bearing flowers, leaves and seed are affected. (B) Large woody stem with black lesions.**

Control measures have not yet been fully developed. Selecting seed from clean fields, seed treatment and keeping sweet clover mowed in waste places and along road ditches should be helpful. Some varieties appear more susceptible than others. Last year (1949) Erector and Brandon Dwarf had considerable black-stem while Iowa Late and Wisconsin Late developed almost none. Willamette, Albotrea, Evergreen and several other varieties were affected some, but only slight damage was noted on these.

<sup>1</sup>Johnson, E. M. and Valleau, W. D., Black-stem of alfalfa, red clover and sweet clover. Ky. Agr. Exp. Sta., Bul. 339, 1933.

### Virus Diseases

The most common virus disease on sweet clover is known as "mosaic". It is readily recognized by mottling or streaking of the leaves. Generally there are yellowish or chlorotic spots or streaks scattered over the green leaves (Plant at left in Fig. 1). It appears that the same virus may be found on red clover, Alsike clover, garden peas (causing the pea streak disease), and on several other nodule-forming species of plants<sup>1</sup>. It is common on both white and yellow varieties of sweet clover in North Dakota.

This virus was easily transmitted by leaf extracts (with abrasive) but not by the pea aphid. It does not infect beans.

Another strain of the mosaic virus on sweet clover appears to be able to infect only yellow sweet clover and beans, and may be transmitted by aphids. This strain has not been observed here. Some varieties appear to be more susceptible than others (Table 2).

**Table 2.** READINGS OF MOSAIC (PEA STREAK STRAIN) ON SEVERAL VARIETIES OF SWEET CLOVER AT FARGO, JUNE, 1949.

Variety	Flower color	Per cent of plants infected
Erector.....	yellow	20
Alborea.....	"	12
Madrid.....	"	8
Spanish.....	white	30
Brandon Dwarf.....	"	24
Wisc. Late.....	"	20
Iowa Late.....	"	18
Arctic.....	"	16
Evergreen.....	"	10

The virus probably does not carry over in the seed. Principal source of the infection is from living plants, either in seeded fields or from plants growing as weeds. Mosaic has not caused very extensive damage in this region, although in severe cases it may destroy a considerable portion of the leaves and reduce the yield of seed. Clean cultivation of row crops and destruction of weeds along roads, fence rows, and in waste places help control sweet clover mosaic. It appears possible that mosaic resistance may be found in some new variety of sweet clover. Last year the varieties Madrid (yellow flowers) and Evergreen (white flowers) had the least amount of mosaic infection of the varieties in these test plots.

<sup>1</sup>Hagedorn, D. J. and Walker, J. C., Wisconsin pea streak. *Phytopath.* 39:837-847. 1949.

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