Disease in the Vegetable Kingdom.

by

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My object in presenting this compilation and original research on a subject of so great importance to the agricultural and horticultural world of today is not to give a full knowledge of the innumerable diseases affecting plant life, nor to give a definite understanding of any one class of such diseases, but my object is to present the subject in a very general way so that one may be the better qualified to reason as to discuss many deviations in plant growth which now the beholder vaguely and from day by day with no further knowledge of the nature of such deviations.

It is very probable that from this time plants first made their appearance they had their enemies - both organic enemies, such as derive their sustenance at the expense of plant life, and inorganic destroyers, or those arising from a varied climate. About this earliest possible record of these enemies we have is the fossil remains of insects which are drawn to be closely related to such insects of the present day as now the most destructive enemies of the plant world. A very good example...
of this is the caterpillar - the larva of the butterfly. In the age of man, so far back as we have any record, we know that many of the cultivated vegetables, fruits, and grains now often attacked by blasting, mildew, rats, and many others like maladies, but as the science of botany was unknown at that time, they were not recognized as occurring in nature, but were looked upon as the judgments of God in limiting man's food supply for greater or less period of time, because of his wantoning from the teachings of his God. Many such ideas are prevalent even at the present day among the more ignorant classes; and it is not uncommon to meet with a person who has been unfortunate in the fact of crops who can account for it all in just some such superstitious manner. Many formations, or deformations which now are known as diseases were considered by the ancients as spontaneous outgrowth, in some way connected with the gods, and by the earlier botanists as abnormally differentiated cell formations; and it was not till the middle of the present century that any definite research was made with a view to bringing the fungous plants into any kind of a system.
Before passing to the general treatment of my subject it might be well to define just what is meant by disease as known to us. The word disease is applied to all maladies and morbid states of the body. It is now defined by medical writers to mean a derangement of the normal functions of any part of the body, this being used almost synonymously with the term disorder. Normal means according to a standard or rule, and the harmonious working together of the functions of all parts of the body, according to the normal or standard, gives us what we know as health. But as here read and as read most commonly by botanists throughout the world, "disease may be defined as those disturbances of the structure and functions of the plant which actually threaten the life of the plant." The effects on the diseased plants have been revealed by the microscope which detects in the vessels and cells of the plant the scar, the scarlet and the progress of disease. From such investigations it has been found that diseases arise from several very different sources, and for each of systems, plant diseases are here arranged into three great classes: First, those which result from mechanical injury; Second, those produced by
flowerless parasitic plants:

Third.—These arising from infertile or insufficient plant food.

Taking up the first class, we find a natural division here between those mechanical injuries arising from flowering plants and those arising from the action of animals great and small. Of the injuries received from flowering plants, perhaps the most common are those caused by the Daster or Cuscuta species. This plant is common throughout the wared and especially is it common in many species all through the Mississippi valley. It will be recognized as a smooth, leafless, salmon-colored vine, bearing about sunflowers, ironwoods, tree growths of willows and a hack of other plants, stretching across from one branch to another and from one plant to another, in many places covering large areas. The seed of this species germinates in the soil exactly as a clover seed germinates, but when the delicate stem begins to cling to the stalks of all the stronger plants of either species about it it is arranging itself to live upon their food. It works first, flat-like baines (chonoria) which force their way into the tissues of the victim or hack plant and then absorbs the sap which it regards as its legitimate
plunder. The parasite first attaches the plant on which it elicits and then having become the demand for sap in the upper portion or strangling part it takes to itself all the food which was intended to nourish that portion—adding insult to injury. In the few growing countries this plant is of great injury to the stems of the trees, holding them in a firm grasp, living upon their life. In the author's experience he has observed acres after acres of alfalfa ruined by this insidious looking little plant. Such another parasite, though not so destructive, is the Melothria of Christmas rose. This grows in this country upon cottonwoods, oaks, pines and a few other trees.

Under the head of mechanical injuries received from animals undoubtedly the most common is the work of insects. "Insect work" is of such common occurrence and generally so readily recognized that I need not go into detail as to just how they may be determined, lest to impress more emphatically the fact that these injuries are a form of disease mention will be made of a few of the more common destructive kinds. What person has not noticed great webs completely enveloping a limb of some cottonwood
A walnut tree and on closer examination has found it full of caterpillars intent on devouring to the last remnant every particle of the green foliage at the limbs. These caterpillars migrate from one part of the tree to another seeking what they may devour until in a very short time the tree is so badly defoliated that it is decidedly sickly in its appearance and since its breathing and digesting organs are destroyed it is almost certain to die. Oaks are especially subject to a diseased condition in the outbreak of "galls" caused by the sting of an insect in depositing its egg. Similar galls are to be found on a great many plants - especially woody ones - and in the wild rose they sometimes assume a very beautiful shape and clustered together and of brilliant color. They vary strikingly resemble some form of fruit. Another notable disease of this kind is to be seen in the enlarged pustules of cottonwood leaves, which when broken open are found to contain myriads of small gnats in all the various stages of development. Similar leaf galls are found on the hickory, crabapple, elms and many others. One of the most curious insect diseases is that in which the leaf is all rinded and between the
epidermal layers leaving only the skeleton and internal covering of the organ of necessary to the life of the plant. This form prevails more largely in the smaller succulent plants though not at all uncommon with trees and shrubs. Affecting our cultivated fruits and vegetables, the mention of a few representative types will call to the memory of an observer countless other similar diseases. The plum weevil causes the fruit to fall before normally mature and the apple worm similarly affects the apple. Orange growers suffer from the scale insect. The phylloxera, so well known to European vineyardists, is one of the most destructive of insects. Attacking the roots of the vine it causes a diseased condition in them which destroys their function for procuring mineral food for the plant and so a consequent it dies. In this way vast vineyards have been entirely killed and, Potato plants fall an easy victim to the rapacious attack of the Colorado potato beetle. Beans, peas, and many grains are the home of little weaves. Cabbage is the lord of plenty for the little flea beetle, and many many of our vegetables perish in early youth the victim of the deadly cut worm. These wild
given merely as illustrations of such common
diseases, but besides those more common kinds
I would include a class which, with some persons would
be more apt to criticism. In this class of diseases
produced by mechanical injuries should be placed all
wounds caused by bruises or by the pruning knife,
all lashes of sap, occasions by pruning of otherwise,
and numerous affections arising from violence in transplanting.
The fact that many plants do suffer severely in health
from such causes is indubitable and my definition
of what constitutes a disease must surely include
them.

The second group of plant diseases comprises
all those produced by flavorless parasites. Various
and numerous as the insect diseases are this class
of diseases caused by larvae plant forms is equally
destructive and probably represented by more forms.
Like as many other plant diseases some of them
have been known for years though not recognized
as diseases. The roots and stems of cereals have
long been a pest to the farmer and the raising
of figs and grapes the terror of the horticulturist.
Although so numerous and of such great importance
space will not permit me to enumerate but a few
of the more common and destructive forms. The
most of grains already mentioned is a very common example in all countries. It receives its name from the color its spores impart to the blades and stems of the grain in its earlier stage. Toward the time of ripening of the grain, however, this rust changes its color to intense black. As to its origin there has long been and in some places and with some peoples there is now a prevalent opinion that it is produced in a similar manner to the common rust of iron — viz., exposure to very moist air. While these conditions do favor it yet the action is very different from the chemical action on the iron. The truth was not known till the "rust" was examined under the microscope when it was found to be one of the similar parasitic plants included under the extensive head of Fungi. Smuts of oats, wheat and corn are other common diseases of the farm crops. Ergot is not only a diseased condition of some grains but is to be shunned in the food of animals since it contains a deadly poison. When eaten it has a very serious effect — in small quantities producing abortion in pregnant females and in larger amounts causing death in either sex. Of fruits that suffer much from this class of disease there are many.
The grape leaves are affected with clavary mildew and the fruit itself with the rot. Cherries, plums and prunes are soon destroyed by brown rot which, being very contagious, spreads rapidly and indiscriminately destroying throughout an orchard.

In this last grand division are placed those diseases arising from improper or insufficient plant food. In general appearance these attacks more nearly the conditions recognized as disease in the animal kingdom and perhaps are identified more than any other form, by the general public as a disease condition of the plant. From a physiological point of view death may result from starvation or from suffocation; the process in either case may be partial and gradual or immediate and complete. A fast plant which has been neglected in its demands for moisture will very soon show the effects. The leaves wilt and hang as if lifeless and in fact soon become as unless water is furnished them through the root. A plant grown in poor soil will be weak and sickly and never mature to a valued healthy individual. The life, vigor and usefulness of a tree may be greatly prolonged by the proper application of food rich in cultivation which
brings new food to the feeding rants or in the application of fertilizers. In this material the plant takes into its system it may become severely poisoned just as in animal life. This is more commonly the case in gases rather than in liquid food. In great cities where the air is full of gases it is next to impossible to grow most plants and such as do cling to life are very usually abnormal in growth. So this group of diseases may well be added those arising from sudden changes of temperature or even in a more gradual change; from electric shocks, immutability, strong contractions and the like. These destroy life by disorganizing the protoplasms, breaking up the tissues, and arresting the natural movements. They cause death by destroying the machinery or paralyzing its action.

In conclusion it may be stated that the gradual effect produced by such injurious agencies as various vapors from citrons or factories or by insects or parasitic fungi are precisely the same as those produced by starvation or suffocation. They all work together. Depriving or insufficient nourishment renders the plant liable to the attacks of parasitic organisms
which prey upon its juices and deprive it still further of nutritive support. A mechanical injury received by the plant such as a bruise or cut is very liable to like parasitic attacks. It seems to be clearly demonstrated throughout vegetable life that no one malady is allowed to act alone but one induces another until such a complicated state exist that it is difficult to determine the exact vital one and consequently which to fight most vigorously in an effort to save the plant.

It is not difficult for us to understand the nature of a diseased animal body. Disease symptoms are drawn to ulcers—probably, nearly one. So, if we consider this fact that plants too are living beings, organized and each organ with a function to perform, and all subject to the same natural laws that govern the animal life, it is not a hard matter to understand that they must naturally be subject to disorders which actually threaten their lives.

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