Diseases Affecting Temperate Zone Fruit Production in Central America

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Temperate zone fruit production has not become widespread in Central America in the sense that there exist numerous large plantings adjacent to each other in any particularly favorable area. Certain small villages, some separated from each other by high mountains, others by great distances, have received acclaim as temperate fruit producers. The plantings in these villages, while many, are of small size, as are the scattered orchards in many urban outskirts. This is one of several factors which affect the prevalence of fruit diseases in the region. The comparative isolation of the orchards also provides a barrier to the introduction of new diseases.

It is unknown to what extent diseases have been a factor in holding back progress in the fruit industry over the years. It is a known fact that plant pathologists have had very little to do with the problems of fruit production, since their efforts have been limited, for the most part, to disease problems involving export crops and food crops of major importance. Sporadically, specimens of diseased fruit are received for diagnosis in plant pathology laboratories and sometimes diseased parts of trees are brought in for examination.

However, it is only rarely that plant pathologists are able to visit the plantings from which such material has come. While an occasional visit may provide a plant pathologist with some information about the diseases prevalent at the time of such a visit, hardly ever have plant pathologists been able to visit the same plantings at regular intervals so as to estimate the extent of the annual losses incurred or the relative severity of the various diseases present.

Where there are commercial orchards, they are actually not extensive enough to be subject to crushing losses of capital due to diseases and the lack of their control. Not many owners of orchards in this region possess enough knowledge of modern fruit production methods to make this a specialized industry. It is not uncommon to find that even in what are called commercial orchards, no attempts at all have ever been made to try to reduce losses from diseases. Many owners have never heard of the existence of infectious fungus diseases. Under such conditions disease intensity may build up year after year. Damaging effects of diseases may become even more intensified when fruit is planted on soils which are incompatible or in localities ecologically unsuitable or when unadaptable varieties are used.

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On the rare occasions that control measures are requested of plant pathologists, it is more than likely that the proper time for their application has already passed. Seldom are steps taken for carrying out disease control programs for the years following. Control recommendations given managers and foreman on the scene may not receive acceptance by the owners. Where there is any doubt as to the correctness of a measure which would increase operating costs, the measure is likely to be refused a trial. Anyone looking for research data to support control recommendations would have a hard time finding any resulting from work done in Central America itself. Profitable control measures in one region may not be so in another.

To what extent the condition of locally grown fruit in the markets has held back the development of fruit growing is also not known. The usual consumers of temperate zone type fruit are accustomed to high quality, imported fruit, uniform-sized and colored, attractively wrapped and boxed. They are not favorably impressed, even at lower prices, by local fruit which is undersized, mal-formed, blemished and often partially rotted from disease. Losses by rot in markets may be due to bad conditions right there which favor and increase rotting, but they are also the result of bruising by careless handling during transportation and lack of proper selection of sound fruit by the grower. Since plant pathologists have never been called upon to make studies of market diseases of fruits, the growers lack information as to what diseases are involved, how much fruit is lost and how this is affecting them.

A number of fruit diseases have been reported in lists of diseases affecting crops in several countries in Central America. The Regional Organization, (OIRSA), which is responsible for crop sanitation problems in Central America has published lists which indicate the geographic distribution by countries of diseases of fruit crops and many other crops. What is lacking are surveys of disease prevalence and estimates of annual losses, both in the field and in the markets and means of informing growers that they need to control infectious diseases.

Those fruit diseases which have been observed and diagnosed by the author will be discussed by crop. Brief symptomatological characteristics will be given for the purpose of differentiating between a disease under discussion and others likely to be present on the same host. It is more than a possibility that there may be already present in the area a number of serious diseases which have escaped the attention of plant pathologists altogether. Certainly there are many, which, if introduced, might have disastrous effects on Central American fruit growing. What is attempted here is to focus attention on a number of diseases which have been, or which might become, limiting factors in fruit production in the region. Control of diseases will be discussed only in general terms.

Leaf spotting *(Cercospora mali* Ell. & Ev.) is of common occurrence on mature apple foliage, but this disease rarely produces defoliation serious enough to affect fruit production. Circular, brownish spots, turning gray with age, form on the leaves.

Young buds and flowers, new leaves and twigs, sometimes become covered with a whitish-gray powdery mildew *(Oidium oxycanthae* DC.), which causes drying-out of these parts. Neither this disease, nor another, similar in symptoms *(Podosphaera leucotricha* (E. & E.) Salm, has been observed in epidemic proportions.

Foliage, of trees in plantings subject to almost daily fogs for long periods, has been found to be severely damaged by the thread blight fungus *(Pellicularia koleroga* Cke.). Nearly all the leaves on large branches die; the leaves become fastened together, when near enough to each other, by the threads of the fungus, which can extend with great rapidity along the twigs and fan out on the underside as a dense web, whitish at first turning brown later. This disease is not widespread.

A related fungus *(Corticium salmonicolor* B. & Br.) may cause even greater damage than that just mentioned, because it penetrates and kills the bark, infects the wood beneath and girdles affected branches. Foliage wilts and entire branches die beyond the area girdled. This fungus forms a pinkish-white, cob-web, covering on twigs and larger branches as well. This disease is serious, but it is not common.

An important disease, appearing on foliage, branches and fruit at different times of the year, but still one and the same disease, is that caused by *Sphaeropsis malorum* Pk. which produces the frogeye leaf spot, the branch canker and the black rot of fruit. The leaf spots are circular, later lobed, purple bordered, appearing zoned in the center due to successive areas of lighter shades of brown. Heavy defoliation has been observed. Fruit rot often starts at the calyx end, the affected area turning brown, then becoming black and showing a series of concentric rings as the rot progresses. The entire fruit becomes a black wrinkled mass of leathery texture. Cankers on branches begin as depresed, dark areas which later begin to crack as the tissues harden and die. Old cankers are bordered by a zoned, rough callus formation. When there has been an un-interrupted build-up of the disease over a period of years, a high percentage of the branches will be found cankered and dead, and most of the fruit rotting or already mummified.

In years when ripening coincides with hot, wet weather, still another fruit rotting fungus *(Glomerella cingulata* (Atk.) Spaulding & v. Shrenck), in its Gloeosporium stage, affects much of the crop. Starting with a circular light brown spot, the enlarging rotted area becomes depressed towards the center and appears saucer-shaped. Various spots

may coalesce on the same fruit. Rotting fruits drop prematurely, becoming mummified. This rot is often found on fruits in markets.

Scabby fruits of poor quality found in markets are the result of the disease caused by *Venturia inaequalis* (Cke,) Winter, actually present during the entire growing season on foliage of the trees from which this fruit comes. The small leaf spots are dark brown, with a velvety aspect, due to the presence of fungus fructification. Leaf scab spots differ from others because of the bulging aspect of the upper surface and a corresponding depressed undersurface. Scab lesions on fruit are at first circular, coalescing, when numerous, into irregular patterns of olive-green to dark brown color. The spots become scabby as they crack unevenly due to cork formation which splits the cuticle over the infected area.

Two fungi which discolor fruits without producing rot or scab are *Gloeodes pomigena* (Schw.) Colby, causing sooty blotch, and *Leptothyrium pomi* (Mont. & Fr.) Sacc. which appears as numerous tiny black specks resembling flyspecks. They do not cause serious losses.

Pear *(Pyrus communis L).*

Two leaf spotting diseases have been found to be common on mature pear foliage, fruit development, therefore, not being much affected. The first is that caused by *Cercospora mali* Ellis & Ev., appearing as circular brown spots. The other, caused by *Septoria pyricola* Desm; differs from the first in that only the border is brown colored and the center of the spot is ashy-white, full of very small black fungus fruiting bodies.

Pears in the ripening stage and sometimes fruit in markets are affected by brown rot *(Sclerotinia fructicola* (Winter) Rehm). The rot extends in the fruit from a light brown circular lesion until nearly the entire fruit is affected.

Trees having one or more dead limbs are frequently seen, and fructifications of a wood rotting fungus *(Schizophyllum commune* Fr.) are usually abundant on the dead areas. They are grayish-white, hairy above and less than two inches wide, having grayish-brown, forked gills on the underside. The fungus is a wound parasite, capable of damaging trees only when injured parts are neglected over a long period of time.

Quince *(Cydonia oblonga)*

The brown leaf spot of pome fruits *(Cercospora mali* Ellis & Ev.) has also been found on quince foliage, but its effects are not serious. The leaf spot caused by *Fabraea maculata* (Lev.) Atk., in its Entomosporium stage, produces severe defoliation. The spots are circular, dark brown to purple, with a small black, raised area in the center, consisting of fructifications of the fungus. The frog-eye leaf spot *(Sphaerop-*

sis malorum Pk.) has also been found on quince foliage and also thread blight *(Pellicularia koleroga* Cke), the latter in plantings, subject to frequent cold fogs, where pink disease *(Corticium salmonicolor* B. & Br.) was also observed to be responsible for killing many branches.

Peach *(Prunus persica* (L.) Batch.)

The most common disease of peach foliage is rust *(Tranzschelia discotor* (Fckl.) Tranz & Litv., formerly T. *pruni-spinosae* (Pers.) (Diet.) While rust causes premature defoliation it is not known to what extent this devitalizes the trees, the usual explanation given for retarded growth being a possible non-adaptability of the varieties planted. Leaves with rust show numerous, very small, irregularly shaped, pale yellow spots, visible on the upper side of the leaves. The areas on the underside, corresponding to the yellow spots above, are covered by a powdery reddish-brown dust, consisting of the spores of the fungus, spreading out from the rust pustules. Later, the yellow spots turn brown as the tissues die in the heavily infected leaves.

On fruit, the most common disease encountered is brown rot *(Sclerotinia fructicola* (Winter) Rehm.) producing losses, both on trees when the fruit is ripening, and in markets. Where it was a practice to tie paper bags around fruits for protection against birds, rotting of the fruit was especially severe. Warm, wet weather also increased fruit rot.

Peach leaf curl (*Taphrina deformans* (Fckl.) Tul.) has been found only in plantings at higher altitudes, where rain and fog, along with cold nights and mornings, combine to make new growth quite succulent and very susceptible to infection. A large section, if not the entire leaf, becomes distorted, due to abnormal thickening, producing a curling effect, with irregular folding of the tissues, rounded on the upper side, appearing to have hollowed chambers on the corresponding underside. Leaf curl is conspicuous even in its early stages by the reddish-purple color of infected parts. Later the predominanting color is yellowish-brown as the leaves die and defoliation begins.

Scab of peaches *(Cladosporium carpophyllum* Thuem.) is common in plantings subject to cold wet weather, but it was not observed in drier areas. Infected twigs lose their smooth appearance, becoming covered with scabby, oval or circular blotches, brownish with grayish borders. Fruits have numerous, small, circular, superficial spots, grayish-green in color, velvety to the touch. When these coalesce to form larger blotches, the fruit becomes misshapen and cracks appear.

Plum *(Prunus americana* Marsh.)

Rust *(Tranzschelia discolor* (Fckl.) Tranz & Litv.) is common on mature foliage of plum trees without causing any appreciable damage. This seems to be true also for several kinds of leaf spotting on this host in the area.

Strawberry (*Fragaria* spp.)

Leaf spot of strawberry (*Mycosphaerella fragariae* (Tul) Lindau) is widespread, but it is usually not as serious as it is conspicuous. The spots are circular, purplish in color at first, but later showing only a border of purple as the center becomes grayish-white. Foggy weather favors the disease.

Considerable fruit is lost from rot, caused by *Botrytis cinerea* Pers., when it ripens during prolonged periods of warm, wet weather. The fruits become covered with a powdery, gray mold. When this fungus infects the blossoms a serious reduction of the crop may follow. In markets, fruits, which have been bruised in handling, may rot due to this fungus or another, called black mold, (*Rhizopus nigricans* Erh.)

A virus disease of the yellow mottling type was encountered in various localities and may be a threat to strawberry growing.

Blackberries and Raspberries (*Rubus* spp.)

Anthracnose of blackberries (*Elsinoe veneta* (Burk.) Jenkins), in its Sphaceloma stage, has been found both on this host and on raspberries, affecting the canes, but without serious consequences. Many small oval spots, purple bordered, with slightly sunken grayish centers appear on the canes. These spots may coalesce, giving a scabby appearance as the centers crack irregularly. The larger veins of the leaves show similar spotting.

Rust, is unquestionably the most conspicuous disease of blackberries in the highlands. Various rust fungi affect various kinds of blackberries, but the rust species which is found most frequently is one now named *Gerwasia rubi* Rac. (*Mainsia rubi* (Diet & Nolw.) Jackson or *Spirechina rubi* (Arth.). Rust is diagnozed by the powdery, yellow coating of spores, conspicuous on the underside of the leaves. The rust (*Phragmidium rubi-idaci* (D C.) Karsten), which was found only on raspberries, is more orange colored than yellow, and it is a more serious defoliating rust than those on blackberries.

The only leaf spotting disease observed was that caused by *Cercospora rubi* Sacc., which produces circular, brown spots of minor importance on blackberries.

Grape (*Vitis* spp.)

Downy mildew of grape (*Plasmopara viticola* (B & C.) Berl. & de T.) is a serious disease which causes such a continuous loss of foliage during wet seasons that the vines become weakened and begin to die out in just a few years. Affected leaves have pale yellow areas, visible on the upper surface, which later turn brown as the tissues die. On the corresponding underside there appears a downy web of whitish fructifications of the fungus which becomes grayish. The various parts of the fruit clusters may become covered with the fungus,

turn brown and die. When mature fruit gets infected it rots on the vine.

Foliage developing in dry seasons is subject to attack by the powdery mildew fungus *(Oidium Tuckeri* Berk.). While the leaves do not die as rapidly as in the case of downy mildew, nevertheless premature defoliation occurs. Starting as powdery, white patches on the upper surface, the fungus spreads over the entire leaf. All parts of the fruit clusters become covered with whitish powder. As the fruits enlarge they become mal-formed and split, many falling to the ground.

Another dry season foliage disease, this one severe on viniferous type grapes is rust *(Physopella vitis* (Thuem) Arth. = *Phakopsora vitis* (Thuem.) Syd.). The entire undersurface becomes covered with a yellowish powder and infected leaves dry out and fall prematurely.

Another common foliage disease is leaf spot *(Cercospora viticola* (Ces.) Sacc.) which appears as many, circular brown spots, superficially easy to confuse with other types of spotting. This disease is rarely serious.

Grape anthracnose *(Sphaceloma ampelina* de B.) was found occassionally to be serious in rainy periods on young shoots, tendrils and petioles, producing many small spots which are sunken, whitish in the center and dark bordered. On fruits the spots are similar to those on other parts of the plant and have a scabby appearance due to cracking and splitting of the centers which are ashy-gray in color.

Disease Control

Diseases give rise to many problems and their neglect may nullify efforts to grow fruit for reasonable profit. Many already established orchards consist of a mixture of varieties, the names of which are unknown, and which were not selected originally for resistence to disease. Tested varieties should be chosen for establishing new commercial orchards in accordance with the recommendations of horticulturists as to adaptability. Climatic extremes favor different types of diseases, some developing more rapidly in prolonged cold wet weather, others in prolonged warm wet weather. Varieties should be selected which suffer least under prevailing local conditions of weather. Time of ripening of varieties must be considered from this aspect. Fruit rot losses can be lessened in some cases by selecting varieties which ripen early enough to avoid the expected periods of unfavorable weather. Ecological conditions which are favorable for fruit growing should receive firsts consideration in choosing localities.

Even the best chemical control measures will not produce profitable results under conditions which favor the maximum prevaleuce of diseases. Operators, trained to handle spraying equipment efficiently, are scarce in Central American and even they will fail to obtain good results when prolonged adverse weather conditions prevail. The price of fungicides and the equipment for their application is high and neither is readily available on the market. Research on fungicides,

designed to show what chemicals would be most profitable to use under local conditions is sorely needed. When chemical control measures are used for the first time in long neglected orchards, the results desired are not usually obtained on account of the degree of intensity of the diseases which have become firmly established over a long period

Summary

Factors which affect the prevalence of diseases in Central America, such as isolation of plantings, great distances and mountainous topography, are discussed.

Reasons for the lack of information as to what extent diseases are responsible for holding back progress in the fruit industry are given and reasons why disease control programs are not in common use are explained. Control of diseases is discussed in general terms only, in view of the absence of significant research data on this subject, especially in the field of comparative effectiveness of fungicide applications.

The matter of disease losses of fruit in markets is taken up. The question of the effect of diseases in the plantings in relation to the condition of fruit in markets is discussed.

Those fruit diseases which have been observed and diagnosed by the author are discussed by crops. These include apple, pear, quince peach, plum, strawberry, raspberry; blackberry and grapes. Brief symptomatological characteristics are given for the purpose of differentiating between the diseases present on each particular host under discussion. No effort is made to present a comprehensive survey of plant diseases by host, nor to include diseases studied by others. What is attempted is to focus attention on a number of diseases which are considered by the author to have been, or which might become, limiting factors in fruit production in Central America.

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