TWO NEW RASPBERRY DISEASES.

F. H. HALL, F. C. STEWART AND H. J. EUSTACE.

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Two New Raspberry Diseases.

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F. H. Hall.

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Raspberry Cane Blight.

For several years raspberry plantations in New York State have suffered quite severely from a disease which "kills back" the fruiting canes. Owners did not recognize the trouble as a disease, however, but ascribed the injury to winter-killing or the effect of drought. They did not bring the condition to the notice of scientists, so it was not until 1899, when the Station Botanist and assistants were making a plant-disease survey of the Hudson Valley, that students became aware of the existence of such a disease. It was then found to be quite prevalent and destructive in many plantations, and has since been observed in most of the raspberry fields examined in different parts of the State. It has also been reported from Ohio, Connecticut and Wisconsin.

* This is a brief review of Bulletin No. 226 of this Station, on Raspberry Cane Blight and Raspberry Yellows, by F. C. Stewart and H. J. Eustace. Any one specially interested in the detailed account of the investigation will be furnished, on application, with a copy of the complete bulletin. The names of those who so request will be placed on the mailing list to receive bulletins regularly, either popular edition or complete edition, as desired. Bulletins are issued at irregular intervals as investigations are completed, not monthly.
PLATE I.—RASPBERRY CANE BLIGHT.
It usually affects fruiting canes, although sometimes young canes are attacked and killed during the first season. The cane puts out foliage as usual, unlike the winter-killed cane; but the leaves suddenly wilt and become dry. The injury occasionally ceases with the death of a single branch; sometimes it extends down one side of the cane, killing all branches on that side; more rarely, it destroys the entire cane. With black caps, this is the general course of the disease, which often starts in the old stub left by pruning; but with red varieties the injury is more liable to be confined to definite sections of the cane. Here the bark is dead and the wood brown, at first only part way around the cane, so that the leaves above are supplied with sap through the remaining uninjured strip of bark; but the completion of the girdle, through the advance of the disease, causes the leaves above to wilt suddenly and die. The tip of the cane, only, may die, half the cane, or all of it, according as the seat of the disease is located on the stem; for parts below the girdle remain apparently healthy and vigorous. The affected canes may die at any time, but the outbreak usually is at its height as the fruit ripens; when the berries, as well as the leaves, dry up on the canes.

When such a sudden wilting occurs, the affected area may usually be located by careful examination of the bark of the cane. This is usually lighter colored than healthy bark, smutty and with smoke-colored patches, where the spores, or seeding bodies, have covered the bark. In many cases minute pimples appear on the surface of the bark, which are due to the formation and opening of the tiny cases which contain the spores of the fungus. The wood beneath indicates more strikingly the presence of disease: for it will be found strongly discolored and usually very brittle.

Frequently red raspberry canes will show, in August and September, brown or bluish-black areas of considerable size, from one inch to four inches in length and extending half or two-thirds round the cane, with limits well defined.

These were at one time thought to be an early stage of cane blight; but careful investigation proves them due to a different and practically harmless fungus. The bark, only, is affected, the
PLATE II.—THE DISCOLORED AREAS CAUSED BY SPHÆRELLA.
sapwood remaining healthy. This is the essential point and the one which must be depended on in separating the work of the two fungi; for the later stages of Sphaerella rubina (which is the scientific name of the bark fungus), are almost indistinguishable from the outward signs of cane blight. The areas affected with cane blight are usually marked by a smutty appearance, if the spores have been shed, while the Sphaerella areas are clean. The canes affected by the latter fungus alone do not seem to be impaired in vitality; the surface growth of the Sphaerella making it a harmless dweller on the canes.

**Extent of damage.**

Cane blight is so common that practically every plantation shows more or less of it, though in most cases the amount of damage done is slight. Very rarely does it destroy an entire crop, but in many cases from one-fourth to one-half or even two-thirds of the crop has been lost.

It is generally more destructive in old plantations than in new ones, the damage, as a rule, increasing with the age of the bushes; but some instances have been known where a severe attack in the early life of a plantation has been followed by practical disappearance of the disease. It probably thrives best and spreads fastest in wet seasons; but the loss may show most in a dry season following a wet one, since it is in the second season following the infection that the wilting and death are most likely to occur. The disease will probably be most destructive when a warm, wet summer and autumn, suitable to infection, are followed by a warm spring and by drought in July when the fruit is ripening. The warmth of the spring would promote vigorous growth of the fungus and the lack of moisture in the soil at fruiting time, when the demand for water is heaviest, would increase the liability to wilting.

**Varieties affected.**

So far as known, no variety of raspberries is exempt from this disease, but some are much more seriously affected than others. Cuthbert appears to suffer worst of all, and it is probably largely owing to cane blight that Cuthbert has such a tendency to dry up at fruiting time; which defect is causing growers who raise for canning factories to substitute Columbian for it. The latter
is notably resistant to the disease. Marlboro, Ohio, Gregg, Kansas, Superlative, I.X.L., and Pride of Geneva also suffer severely. The wild red raspberry is often attacked; and it is believed that the same fungus is responsible for a similar disease on the cultivated dewberry.

**Cause.**

The disease is due to a fungus, whose exact identity and place in the scientists' scheme of classification is not as yet fully determined. It is certain that it is of the genus *Coniothyrium*; but whether it is *Coniothyrium fuckelii* or is a new species, very closely allied to the latter, remains unsettled. *Coniothyrium fuckelii* is reported from Europe as occurring on the bark of dead and dying branches of several species of plants, including raspberry, but no specimens of it on raspberry have been available for comparison; and the known example of it on trumpet creeper differs slightly from the specimens on diseased raspberries in America.

Uncertain though the name of the fungus may be—whether John Smith or James Smith, as we may express it—it is very certain that the particular form under observation is the cause of the disease; for it has been subjected to all the scientists' tests to establish its relationship to the disease. It was always present on diseased canes, no other fungus was present in many cases, and it was absent from perfectly healthy canes. In addition to this, healthy canes, inoculated from pure cultures of this fungus and protected from access of all others, produced typical specimens of the disease. Cultures made again from these artificially produced disease spots showed all the characteristics of form, color, size and method of growth of cultures from the original diseased tissue. Thus the chain was completed—not once but many times.

The inoculation experiments proved also that the fungus is parasitic on both red and black raspberries, but it did not "take" in the single experiment with blackberry and dewberry. It attacked fruiting canes somewhat more readily than new canes, but produced the disease on both, the fungus being mature in two months.
In the field, infection takes place largely in summer and autumn, to show in wilted fruiting canes the next season, but it also occurs to some extent in new canes in the spring. The fungus commonly gains entrance through wounds. The dead stubs left by pruning—heading back or the removal of branches,—the abrasions caused by canes rubbing against each other or against supports, the split crotches between branches, and the slits made by the ovipositors of snowy crickets, are frequent starting points for the disease, especially if the wound is so located as to retain moisture.

As to the manner of spreading of the disease not very much is known; but it is certainly spread by infected nursery stock, by winds and dashing rains, by birds and insects, by pickers in gathering the fruit, by pruning and cutting out old canes, and particularly in the process of laying down and covering the canes to protect from winter injury. The pieces of dead cane lying on the ground may also be the source of infection, as the fungus can live on dead and decaying wood. The disease probably does not travel to any distance except on infested plants.

It was thought that cane-blight might be controlled by spraying, but one season’s experiments do not give favorable results. A plantation of 1½ acres of Cuthberts, at Charlotte, was selected for the test. The plantation had been badly affected by cane blight in 1901, so that two-thirds of the crop was lost. In May, 1902, it appeared to be in good condition,—canes large and strong and foliage healthy; but many diseased canes were found. A little over half the rows were sprayed, sets of four rows treated and untreated alternating throughout the plantation. Three thorough sprayings of 1-to-10 Bordeaux mixture were made,—on May 26, June 4 and June 16—using about 150 gallons to the acre. On August 2 it was seen that spraying had not checked the disease, as there were apparently as many dead canes in the check rows as in those sprayed. The yields also proved that the spraying was of no avail, since the check rows outyielded those sprayed to quite an extent. It was thought that the spraying actually lessened the yield, probably through its effect on fruit setting, since many
blossoms were open when the last spraying was made. It is possible that spraying continued throughout the entire growing period of the new canes, thus covering two seasons, may be more effective; but it is very difficult to spray raspberries effectively, since the "bloom" prevents adhesion of the spray.

Other repressive measures which should be carefully attended to are: (1) To start with healthy plants, dealing only with grower near at hand where the nursery can be personally examined, or with those whose word can be depended on, who know the disease and who will guarantee their stock free from infection. (2) Do not plant on the site of diseased plantations, since it is not known how long the fungus can live in the soil, though certain that it can do so for some time. (3) Immediately after fruiting cut out and burn the old canes, thus removing at least one very prolific source of infection.

**Raspberry Yellows.**

The name "raspberry yellows" is proposed for a new disease, which, joined with cane-blight, has so affected the Marlboro red raspberry that this excellent variety is said in many sections to be "running out." This disease is quite characteristic in its manifestations, affected plants taking about the same course wherever situated, so it is evidently a specific trouble; but, like peach yellows and little peach, no cause and no preventive have yet been found for it.

Plants attacked by yellows have a stunted, yellowish aspect suggestive of peach yellows. On fruiting canes the fruit-bearing laterals are dwarfed, often to one-half their normal length. The leaves are small, curled slightly downward at the margins and faintly mottled with yellow. Some of the berries dry up without ripening and those that ripen are undersized and insipid. Much of the foliage withers at the same time. New canes, for the most part, are not seriously checked in growth although their foliage is usually more or less affected. The foliage on new canes does not wither and there are rarely to be found any dead spots or areas. The leaves on the upper portion of the cane may be much mottled while those on the lower portion are nearly or quite normal. The
reverse may also happen. Badly diseased canes and apparently healthy ones may occasionally be found in the same stool. However, it is often difficult to determine whether a particular cane is or is not diseased because the transition from normal canes to badly diseased ones is by imperceptible gradations. Except in the later stages of the disease and when also attacked by cane blight, the canes themselves do not show injury. The roots, too, appear normal but more observations must be made before it can be stated positively that the roots are entirely unaffected.

This disease is a very important one and deserves more attention from plant pathologists than it has yet received. Although especially destructive to the Marlboro it is by no means confined to that variety. It has been observed on several other varieties and black caps, among which are Coutant No. 1, Cuthbert and Kansas.

The name yellows is given the disease, not because of any supposed relation to peach yellows, but because it is descriptive of the appearance of affected plants. The red rust of blackberries and raspberries, due to the fungus Caomna nitens, is sometimes incorrectly called yellows. For this disease, red rust is the proper name inasmuch as it is caused by a true rust fungus.

The cause of raspberry yellows is not known. At one time we suspected that the red spider (Tetranychus telarius) was responsible for it, but that idea has been abandoned. It is safe to say that it is not caused by any fungus attacking the leaves.

No remedy or preventive is known. Commercial fertilizers in various combinations were used in a carefully conducted experiment to ascertain if some soil deficiency might not be at the bottom of the trouble; but none of the applications had any specific effect on the disease.

Spraying with Bordeaux mixture also fails to check the spread of the trouble, as was clearly proved by tests in an infected plantation in 1901 and 1902. The rows sprayed 13 times were quite as much affected as the checks.