BACTERIAL BLIGHT OF *PHASEOLUS VULGARIS* VAR. WHITE KIDNEY.

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INTRODUCTION.

The cultivation of French beans, *Phaseolus vulgaris* L., on the Agricultural College Farm at Poona, was first undertaken some thirty years ago, and since then a variety known as 'White Kidney' has been grown annually in the cold season. In 1943, a destructive blight of this crop was observed, and isolations made from diseased plants gave a bacterium in pure culture. A study of this disease and its causative organism was made, and the results of this study are reported in the following pages.

DISTRIBUTION AND ECONOMIC IMPORTANCE.

Bacterial blight of French beans was first recorded in New York in 1892 (Beach, 1892), and has since been reported from some other States in the U.S.A. Delacroix (1899) reported bean blight—called by him 'grease disease'—as occurring on garden bean grown around Paris in France. It has also been recorded in many other European countries, the Philippines, Australia, New Zealand and South Africa. As stated above, it was not recorded in this country prior to 1943.

In the U.S.A., where there is an extensive cultivation of French beans, Muncie (1917) has estimated that fully 30% of harvested beans are affected by blight, although the extent of damage caused by it is often difficult to assess mainly due to its constant association in the field with bean anthracnose caused by *Colletotrichum lindemuthianum* (Sacc. and Mag.) Br. & Cav. At Poona, infection varied from 50 to 100% in different plots, the disease being widely prevalent and extremely destructive in plots situated in low-lying areas on the Farm.

The main effect of the disease is defoliation of affected plants. Pods of such plants also remain immature and yield small, shrunken seed of poor germinative power. If young pods are attacked, they soon drop down, but infection of older pods results in their disfigurement and consequent reduction in their market value. Young seedlings, when affected, do not develop properly and remain stunted and weak. In severe cases, the whole plant may be completely destroyed.

DESCRIPTION.

The disease attacks all the above-ground parts of the plant. The symptoms produced by it on different parts of the plant are described below.

On leaves.—The first visible symptoms appear as necrotic lesions near the margins of the leaflets, but these lesions do not become water-soaked under the conditions at Poona. The necrotic areas enlarge in extent until the entire leaflet is involved, or they may remain localised. They have a yellow border, which in turn is surrounded by a pale green zone. These areas are at first yellowish brown but later change to dark brown (Plate IX). When an entire leaflet is involved, it becomes papery and brittle and remains hanging from the plant. Young leaves generally drop down after considerable invasion of their tissues has taken place. In severe cases, the older leaves become ragged and the entire plant assumes a wilted

appearance. Leaf blight is the most serious aspect of the disease as it results in defoliation of the affected plants.

On stems and petioles.—The disease first appears as reddish brown spots on stems and petioles. These spots enlarge along the stems and petioles in the form of longitudinal streaks of dark brown colour. The streaks are slightly raised, causing a rupture of the epidermis and exposure of the inner tissues. In severe cases, the stem is girdled by the disease, and such plants are weakened and easily break under the force of strong wind.

On pods.—The lesions on the pods are at first water-soaked and dark green in colour, but they gradually enlarge and their tissues become dry and turn brown. These spots are slightly sunken with raised edges, and are generally round. Bacteria ooze out of these spots in large numbers and, when dry, a yellow incrustation of these organisms covers the spots. Affected pods shrivel up, and, if infection travels down to the pedicels, the latter are weakened and the pods drop down. Such pods contain only a few shrivelled, immature seeds which give poor germination.

On seeds.—On the seeds of White Kidney variety of beans, the disease produces yellow, irregular blotches of various sizes. Diseased seeds are smaller than the healthy and generally have a dull appearance. In severe cases, the seeds may be wrinkled, and there is invariably a yellow spot at the hilum. Such seeds, when sown, fail to germinate, or the seedlings originating from them are weak and become diseased. Seeds are thus an important source of transmission of the causative organism of the disease.

On coloured seeds, blotching is not easily detected, but in the variety 'Dwarf Horticultural', the seeds of which are reddish brown, slight wrinkling and discoloration of the seeds are quite discernible.

When grown in pot culture in the glasshouse, the seedlings originating from diseased seeds exhibit characteristic 'snake heads', and their growing tips are either injured or completely destroyed. Such seedlings fail to make any growth.

Isolation of the Organism.

The organism was easily isolated from diseased leaves by the usual poured-plate method. Fresh specimens of infected leaves showing necrotic areas were brought from the field and washed in tap water. Small pieces of the leaves showing young lesions were cut out, dipped in 95% alcohol and subsequently disinfected in a one in 1,000 solution of corrosive sublimate, followed by rinsing in three changes of sterile, distilled water to remove the sublimate. Three to four such pieces were put in sterilised Petri dishes, each containing a small quantity of sterile water, and crushed with a flamed scalpel or sterile rod for about 10 minutes so as to allow bacteria to diffuse out into the water. Ten ml. of potato dextrose agar, previously melted and cooled down to 45°C., was poured in each plate which was rotated several times in order to ensure uniform distribution of the bacteria in the culture medium. When the agar had solidified, the plates were incubated at 32°C. in an inverted position. Colonies of the organism appeared in 3 to 4 days, and sub-cultures were made on potato-dextrose agar slants.

Inoculation Experiments.

Inoculation experiments were done to test the pathogenicity of the organism isolated from French bean, and are described below.

The whole plant.—Young, vigorously growing French bean plants of White Kidney variety raised from healthy seeds were selected for inoculation experiments, and pots containing these were allowed to stand in a basin of water and covered with bell-jars for 24 hours. Next day, the plants were inoculated by spraying them with a suspension of the organism in sterile water, and again covered with bell-jars

for 24 hours. Control plants were sprayed with sterile water only. Both the inoculated and control plants were then removed to the glasshouse for further observation.

The first signs of infection appeared in about a week as small, necrotic lesions on leaves, stems and petioles of inoculated plants. The lesions rapidly increased in extent, and after three weeks all the inoculated plants were severely blighted and died subsequently. The organism was re-isolated from dead plants and resembled the original culture in all respects. Control plants remained healthy during the period of the test.

Stem.—The general procedure of the experiment was the same as that described above, save that inoculations were carried out by pricking the organism into the vascular tissues of the stem. The proposed sites of inoculation were first disinfected and washed in sterile water. A loopful of the inoculum from a young culture was then applied to a node or an internode, and punctures were made through the drop of the inoculum with a flamed needle. The sites of inoculation were finally covered with beeswax and wrapped with wet cotton wool. Controls were similarly treated, but sterile water was used in place of the inoculum.

Inoculated plants began to wilt in about a week after inoculation and died within a few days. The organism was re-isolated from the stems and petioles of wilted plants. Control plants remained healthy.

Pods.—The pods were inoculated in the same manner as the stem and leaves. Both the spray and puncture methods of inoculation were employed. Infection became visible three days after inoculation when the tissues were punctured with a needle, and after a week when the pods were sprayed with a suspension of the organism. Infection was most severe on immature pods which became chlorotic and dropped down. Imperfectly mature pods developed characteristic necrotic lesions which were depressed in the centre and slightly raised at the edges. Fully mature pods, however, took on infection only when inoculations were carried out by wounding the tissues.

Morphology of the Organism.

The organism is a short rod with rounded ends, occurring singly or in pairs, sometimes in chains in young cultures. In cultures of potato-dextrose agar varying in age from 24 hours to 3 weeks, the average dimensions are $1{\cdot}47\mu(0{\cdot}92$ to $2{\cdot}9\mu) \times 0{\cdot}63\mu(0{\cdot}3$ to $0{\cdot}92\mu)$. It is motile with a single polar flagellum, Gram-negative and not acid-fast. It does not produce spores but produces distinct capsules.

Cultural and Physiological Characters of the Organism.

Potato-dextrose agar (2%).—In plates: Growth smooth, glistening, convex. Colonies round, with entire margins, colour empire yellow (Ridgway), 0·2 to 1·2 cm. Consistency butyrous. No distinctive odour.

On slants: Growth copious, smooth, glistening, filiform, opalescent. Consistency butyrous, flowing to bottom of the tube.

Nutrient agar.—In plates: Growth slow and poor, smooth, glistening, convex. Colonies round, with entire margins, colour baryta yellow (Ridgway), 0·1 to 0·2 cm. in 7 days. Consistency butyrous. No distinctive odour. Agar becomes buckthorn brown (Ridgway).

On slants: Growth poor, chestnut brown, smooth, dull, filiform, opalescent. Agar coloured raw sienna (Ridgway).

Nutrient broth.—Moderate clouding in 7 days, with formation of a ring at top. No pellicle or sediment. Culture medium coloured brown just below the growth which extends throughout the liquid in about 5 weeks, turning it uniformly brown.

Potato cylinders.—Growth copious, apricot yellow (Ridgway), slimy, glistening, covering the entire surface in about 5 days. Slow disintegration of the potato cylinder into a slimy mass is a distinguishing feature.

Synthetic media.—Of the liquid media tested, there was no growth in Fermi's and Cohn's solutions, whereas a faint clouding occurred in Uschinsky's solution.

Plain milk.—There was good growth in the medium which was rendered acidic.

Litmus milk.—The organism grew well in litmus milk and reduced litmus completely. The upper part of the medium was clear and slightly reddish in colour. No crystals were observed in the medium.

Gelatin liquefaction.—The organism liquefies gelatin.

Starch agar.—The organism has a strong diastatic action on starch.

Fermentation of carbohydrates.—The organism was grown on a synthetic medium containing respectively 1% of sucrose, glucose, xylose, lactose, dextrin, salicin, glycerol and mannitol, and brom thymol blue was added to the medium as an indicator. It grew well and produced acid in the media containing glucose, sucrose, lactose, dextrin and glycerol, but failed to grow on those media which contained xylose, salicin and mannitol.

The organism was also grown in nutrient broth containing glucose, sucrose and lactose. It grew well in all the media but produced acid only in the medium containing sucrose. The media containing glucose and lactose remained neutral.

Indol production.—There was no evidence that the organism produces indol.

Production of hydrogen sulphide.—No H_2S was formed.

Reduction of nitrates.—There was no evidence that the organism was able to reduce nitrates into nitrites.

Oxygen requirements.—The organism failed to grow in the absence of oxygen.

Methyl red and Voges-Proskauer reaction.—Negative.

Relation of temperature to growth.—The organism was grown on potato-dextrose agar at temperatures ranging from 0° to 40°C. It made the best growth at the temperature range 32–35°C., and failed to grow at 3°C. and lower temperatures and at 40°C. It was not killed, however, when exposed to 3° and 40°C., since it resumed growth after transfer to 32–35°C.

Thermal death-point.—About 50°C.

Chromogenesis.—The organism produced a distinct yellow pigment on most of the media tested, but in nutrient broth and on nutrient agar, the pigment was of dark brown colour. The yellow pigment is not water-soluble, but the brown pigment is.

Longevity.

Hedges (1924) has reported that *Phytomonas phaseoli* can remain alive for 1½ years when grown on beef agar in small-bore tubes, and only 3 months when growing on the same medium in large-bore tubes, and kept in an ice box. In order to determine the longevity of the organism causing blight in *Phaseolus vulgaris* var. White Kidney, slants of nutrient agar and potato-dextrose agar were inoculated with a fresh culture of the organism and incubated at 32°C. When sufficient growth had taken place, the tubes were removed to a refrigerator maintained at about 13°C. At regular intervals, transfers were made from these tubes to fresh slants of potato-dextrose agar and incubated at 32°C. The pathogenicity of the sub-cultures was tested on French bean plants. At 13°C., the organism remained alive for about 5½ months without loss of virulence.

Resistance to Desiccation.

As reported by McCulloch (1929), E. F. Smith (1901, 1905–14), Rapp (1920), Wolf (1925) and Edgerton and Moreland (1913) found that *Phytomonas phaseoli*

remains alive for 27, 70, 18 and 200 days, respectively, when dried on glass covers at room temperature. In order to test the resistance to desiccation of the organism causing blight in *P. vulgaris* var. White Kidney, loopfuls of a young culture of the organism on potato-dextrose agar were transferred to sterile glass cover-slips placed in a sterile Petri dish, and incubated at room temperature. At daily intervals, a cover-slip was dropped aseptically into a tube of nutrient broth. The tubes were incubated at 32°C., and observations on growth were made 2 or 3 days after incubation. Control tubes were provided, into which sterile cover-slips were dropped. The results show that the organism can resist desiccation for about 17 days.

Transmission of the Disease.

It has been experimentally shown that bean blight caused by *Phytomonas phaseoli* (Erw. Smith) Bergey *et al.* is transmitted by the seed and carried in the soil. In order to obtain evidence on the transmission of the organism responsible for blight of *P. vulgaris* var. White Kidney, the following experiments were done.

Experiment I.—In this experiment, seeds from badly diseased pods of *P. vulgaris* var. Dwarf Horticultural, collected in the previous season, were sown in sterilised soil. All the plants emerging from these seeds showed positive signs of the disease in about a month after the date of sowing.

Experiment II.—In this experiment, healthy seeds of White Kidney variety were inoculated with the organism. Inoculum was applied to the seeds either as a young culture of the organism in nutrient broth or as a suspension of the organism in sterile water. In each case, the seeds were soaked for 10 minutes in the inoculum and subsequently dried for a month under aseptic conditions. These seeds were then sown in sterilised soil. The disease appeared in the plants a month after the seeds were sown.

Experiment III.—This experiment was designed to test whether the organism of French bean blight was carried in the soil. It was grown for one month in nutrient broth which was then added to sterilised soil. After a fortnight, seeds of White Kidney variety, previously disinfected for 10 minutes in a one in 1,000 solution of mercuric bichloride, were sown in the inoculated soil. The plants originating from these seeds developed symptoms of the disease.

The results of the above experiments indicate that the organism causing blight of *P. vulgaris* vars. White Kidney and Dwarf Horticultural is carried on the seed and is also disseminated through the soil.

Host Range.

For the purpose of determining the host range of the organism causing blight of *P. vulgaris* var. White Kidney, seeds of various plants were sown in sterilised soil in 4-inch pots. When the plants were about three weeks old, the pots containing these plants were placed in large wooden tubs containing water at the bottom. A glass plate was placed over each tub so as to make a moist chamber, and the whole thing was covered with wet gunny sacking. The plants were kept in this condition for 24 hours before spraying them with a suspension of the organism. Before inoculation, all plants were sprayed with sterile water. Inoculated plants were re-placed in the moist chamber and covered over with wet gunny sacking for a further period of 24 hours. They were then removed to a glasshouse and kept there under observation. Control plants were similarly treated but were sprayed with sterile water only. The results, which are recorded in Table I, show that the organism produced infection not only in all the varieties of *Phaseolus vulgaris* tested but also in *P. lunatus*, *P. coccineus* and *Dolichos lablab.*

TABLE I.

Host range of organism causing blight of Phaseolus vulgaris *var. White Kidney.*

Plants inoculated.	Infection.	Symptom of the disease, if any.
Phaseolus vulgaris		
var. White Kidney	+	Blight
var. Longfellow	+	Blight
var. Dwarf Horticultural	+	Blight
var. Idaho Refugee	+	Blight
var. Stringless Green	+	Blight
var. Refugee Wax	−	nil
var. Red Kidney..	+	Blight
var. Refugee, No. 5	+	Blight
var. Full Measure	+	Blight
var. Red Valentine	+	Blight
var. Cream Coloured	+	Necrotic spots
var. Bountiful	+	Blight
var. Yellow Seeded	+	Blight
var. Painted Wax	+	Blight
Phaseolus lunatus	+	Necrotic spots
Phaseolus coccineus var. Scarlet Runner ..	+	Blight
Phaseolus aconitifolius	−	nil
Phaseolus aureus	−	nil
Phaseolus mungo	−	nil
Dolichos lablab	+	Water-soaked necrotic spots on young leaves.
Soja max	−	nil
Vigna sinensis	−	nil
Vigna catjang	−	nil
Cicer arietinum	−	nil
Cajanus cajan	−	nil
Lathyrus sativus	−	nil
Pisum sativum	−	nil
Arachis hypogaea	−	nil
Trigonella foenum-graecum	−	nil
Lens esculentus	−	nil
Crotalaria juncea	−	nil
Medicago sativa	−	nil
Desmodium diffusum	−	nil
Mimosa pudica	−	nil
Cyamopsis psoraloides	−	nil

'+' means positive infection; '−' no infection.

EFFECT OF TYROSINE ON PIGMENT PRODUCTION.

The organism causing blight of *P. vulgaris* var. White Kidney produces a brown, water-soluble pigment when grown in nutrient broth, but the production of this brown pigment in a tyrosine-containing medium has been used by Burkholder (1929) as a character in distinguishing *Phytomonas phaseoli* from its variety *fuscans*. It was worth while to determine whether this organism was able to produce this pigment in a tyrosine-containing medium. Accordingly, a synthetic carbohydrate medium, to which 0·1% tyrosine was added, was prepared and adjusted to neutrality. The organism, when grown on this medium, failed to produce brown pigment, indicating that it is different from *Phytomonas phaseoli* var. *fuscans* in this respect.

TAXONOMY AND NOMENCLATURE.

The results of the study of morphological, cultural and physiological characters of the organism isolated from *Phaseolus vulgaris* var. White Kidney, conclusively

show that this organism is closely allied to *Phytomonas phaseoli* and its variety *fuscans*, but differs from both of them in certain important cultural and physiological characters. In Table II, a comparative statement giving the distinguishing morphological, cultural and physiological characters of the three organisms is presented so as to bring out clearly their resemblances and differences.

The data recorded in Table II show that, whereas the organism isolated from *Phaseolus vulgaris* var. White Kidney has the same host range as *Phytomonas phaseoli*, it can be readily distinguished from the latter on the basis of certain morphological and cultural characters. From *Phytomonas phaseoli* var. *fuscans*, it can be separated not only on the grounds of morphological and cultural differences but also on the inability of the former organism to infect *Dolichos lablab*. However, as the organism isolated from *P. vulgaris* var. White Kidney resembles *Phytomonas phaseoli* in respect of pathogenicity, it cannot be regarded as a distinct species but may be considered a variety of it.

TABLE II.

Comparative data on distinguishing morphological, cultural and physiological characters of the organism isolated from Phaseolus vulgaris *var. White Kidney*, Phytomonas phaseoli *and* Phytomonas phaseoli *var.* fuscans.

Characters.	Organism isolated from *P. vulgaris* var. White Kidney.	*Phytomonas phaseoli* (Erw. Smith) Bergey *et al.*	*Phytomonas phaseoli* var. *fuscans* (Hedges) Burkholder.
Pathogenicity on—			
Phaseolus vulgaris	+	+	+
Phaseolus lunatus ..	+	+	+
Phaseolus coccineus	+	+	+
Dolichos lablab ..	+	+	−
Vigna sinensis ..	−	−	−
Soja max ..	−	−	−
Pisum sativum ..	−	−	−
Medicago sativa ..	−	−	−
General effect on hosts	Water-soaked areas on pods of French beans and on leaves of *Dolichos lablab*.	Water-soaked areas on leaves, stems and pods of its hosts.	Water-soaked areas on leaves, stems and pods of its hosts.
Morphology ..	Distinct capsule.	No capsule as reported by various workers but once observed by McCulloch (1929).	No capsule.
Cultural characters—			
(*a*) Nutrient agar plates.	Growth poor, convex. Colonies round, with entire margins, colour baryta yellow, 1 to 2 mm. in 7 days. Consistency butyrous. Medium changes to buckthorn brown.	Growth good. Colonies round, with entire margins, amber yellow, 3 to 5 mm. in 7 days. Consistency butyrous. Medium remains unchanged.	Growth abundant. Colonies round, with margins entire to slightly undulating, a watery—appearing zone about the edge, honey yellow, 10 mm. in 7 days. Consistency watery to butyrous. Medium turns brown.
(*b*) Nutrient agar slants.	Growth slow and moderate, not collecting at bottom, chestnut brown. Medium turns brown.	Growth abundant, amber yellow.	Growth abundant, mustard yellow. Medium turns brown.

TABLE II—*Continued.*

Characters.	Organism isolated from *P. vulgaris* var. White Kidney.	*Phytomonas phaseoli* (Erw. Smith) Bergey *et al.*	*Phytomonas phaseoli* var. *fuscans* (Hedges) Burkholder.
(*c*) Nutrient broth	Broth cloudy in 48 hours, yellow ring at top, no sediment. Medium turns brown in 3 weeks.	Broth cloudy in 24 hours, yellow ring at top, heavy sediment. Medium not pigmented.	Broth cloudy in 24 hours, light yellow ring at top, slight flocculation in medium, yellow sediment. Medium turns brown in 3 weeks.
(*d*) Reaction in milk:			
Plain milk ..	Acidic.	Alkaline.	Alkaline.
Litmus milk ..	Litmus reduced, no crystals, upper part reddish liquid, sediment pinkish red.	Litmus reduced, upper part slightly reddish, lower part muddy, yellowish brown medium with crystals.	Litmus reduced, upper part purple brown, lower part muddy, medium brown.
Fermentation of carbohydrates.	(*a*) Acid but not gas from dextrose, sucrose, lactose, glycerol.	(*a*) Acid but not gas from dextrose, xylose, sucrose, lactose, glycerol.	(*a*) Acid but not gas from dextrose, xylose, sucrose, lactose, glycerol, mannitol.
	(*b*) No growth in xylose, mannitol, salicin.	(*b*) No growth in mannitol and salicin.	(*b*) No growth in salicin.
Chromogenesis ..	Yellow pigment in all media other than nutrient broth, in which pigment is dark brown.	Yellow pigment in all media.	Deep brown pigment in most of the media.
Longevity:			
(*a*) Viability ..	Remains alive for 5½ months on nutrient agar and potato-dextrose agar, at 13°C.	Dies in ½ month when grown on nutrient agar and kept at 14°C.	Dies within a month. Brown pigment in medium hastens death of the organism.
(*b*) Virulence ..	Not affected by age.	Slightly affected by age.	Not reported.
Effect of tyrosine on pigment production.	Yellow pigment.	Not reported.	Deep brown.

Recently, Dowson (1943) has questioned the validity of the generic names *Erwinia* and *Phytomonas* which are regarded in Bergey's system (1939) as groups containing only bacteria pathogenic to plants, irrespective of all other characters. He has suggested that these names should be rejected because the plant pathogens of the genus *Erwinia* should be included in the colon-typhoid group with which they are closely allied, and those belonging to the genus *Phytomonas* with the closely related green fluorescent bacteria. According to his suggestion, *Bacterium* Ehrenberg, 1828, should be designated *nomen conservandum* and so re-defined as to include not only those species constituting the colon-typhoid-dysentery group but also the peritrichous plant pathogens, and *Pseudomonas* Migula should be split into two genera, namely, *Pseudomonas* Migula em. Dowson to include the green fluorescent bacteria with a tuft of polar flagella, and *Xanthomonas* Dowson for the yellow forms with a single polar flagellum. This proposal recognises the close affinities of the bacterial plant pathogens with the colon-typhoid group and the green fluorescent

bacteria and assigns them a natural position in the classification. *Phytomonas phaseoli* (Erw. Smith) Bergey *et al.* accordingly becomes *Xanthomonas phaseoli* (Erw. Smith) Dowson.

As blight caused by *P. vulgaris* var. White Kidney has been recorded for the first time in India, it is proposed to name it as a new variety *indicus*, and a technical description of this variety is given below.

Xanthomonas phaseoli (Erw. Smith) Dowson var. *indicus* var. nov. Uppal, Patel and Nikam.

Short rods with rounded ends, 1·47μ(0·92 to 2·9μ)×0·63μ(0·3 to 0·92μ). Single or in pairs, sometimes in chains in young cultures. Capsules present. Motile by a single polar flagellum. Gram-negative. No spores and not acid-fast. Aerobe.

On potato-dextrose agar colonies are circular, with entire margins, smooth, convex, glistening, butyrous, empire yellow (Ridgway). Growth in nutrient broth is moderately cloudy, a ring is formed, and medium becomes brown. The optimum temperature for growth is 32–35°C.; no growth at 40°C. Thermal death-point is about 50°C. The organism liquefies gelatin and has a strong diastatic action on starch (as seen from copious growth on potato cylinders); it does not reduce nitrate or produce indol or hydrogen sulphide. It produces acid in plain milk and reduces litmus milk. It produces acid but not gas from dextrose, sucrose, lactose and glycerol. It cannot utilise xylose, mannitol and salicin. It makes no growth in Fermi's and Cohn's solutions and only slight growth in Uschinsky's solution.

Pathogenic to *Phaseolus vulgaris, P. lunatus, P. coccineus* and *Dolichos lablab.*

SUMMARY.

Bacterial blight is a serious disease of *Phaseolus vulgaris* var. White Kidney grown on the Agricultural College Farm at Poona. The symptoms of this disease have been described.

A bacterial organism was isolated from diseased plants of *P. vulgaris* var. White Kidney, and on inoculation proved pathogenic to healthy plants. The morphology and cultural and physiological characters of the organism have been described. The organism is closely related to *Xanthomonas phaseoli* (Smith) Dowson and has the same host range as the latter. It, however, differs from *Xanthomonas phaseoli* in certain morphological and cultural characters, and accordingly, it is considered a new variety of the latter organism. Evidence has also been presented in support of the organism causing blight in *P. vulgaris* var. White Kidney as being quite distinct from *Xanthomonas phaseoli* var. *fuscans* (Burkholder) Dowson. The name proposed for the organism is *Xanthomonas phaseoli* var. *indicus* nov. var.

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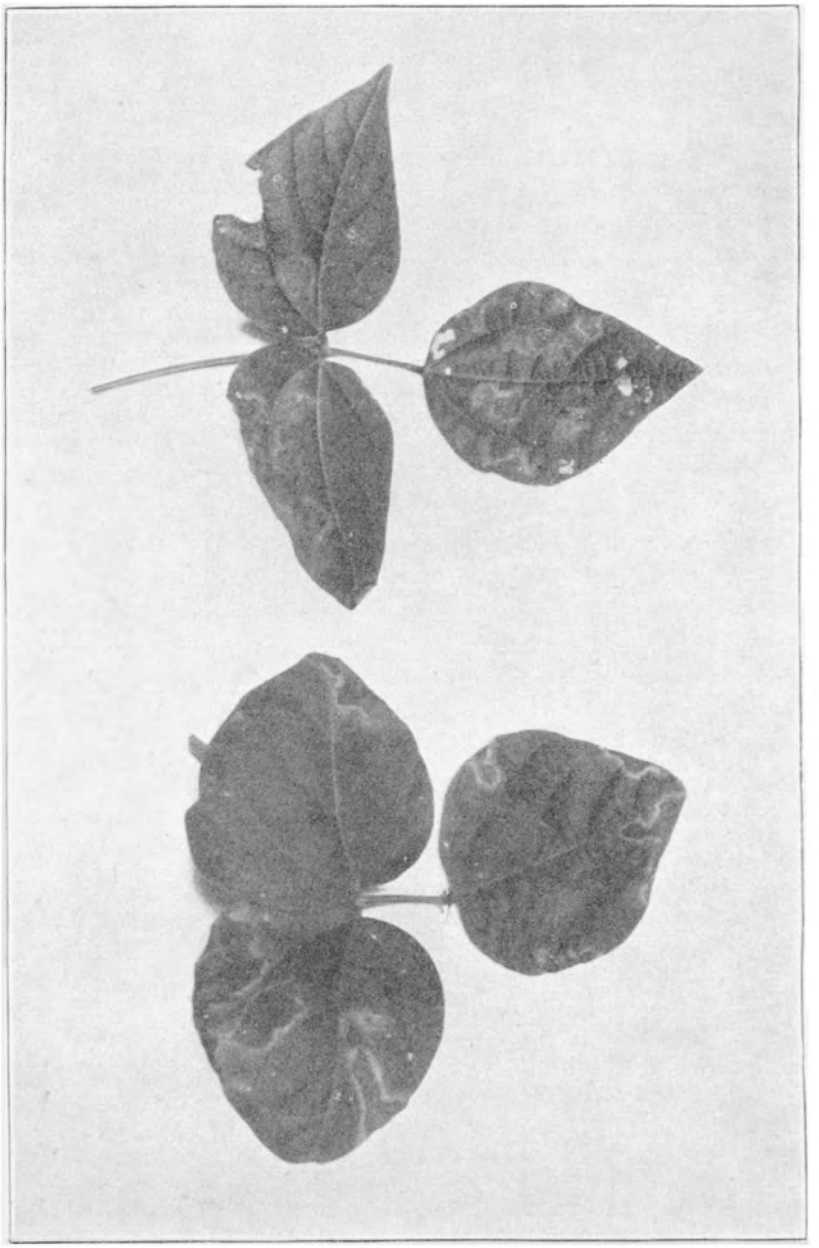

Leaves of French Bean showing necrotic lesion surrounded by a zone of yellow tissue.