A BACTERIAL BLIGHT DISEASE OF CORIANDER

By M. C. Srinivasan, M. K. Patel and M. J. Thirumalachar

Received November 17, 1960

(Communicated by Prof. L. S. S. Kumar, F.A.SC.)

Introduction

Coriandrum sativum L. is widely cultivated in India for its aromatic leaves and seeds used as condiment and spice. A severe bacterial leaf-spot and blight was first noticed near Poona, and later in many other places. The damage is often considerable in green plants which are cut and marketed. The diseased leaves under moist enclosed conditions begin to rot and also provide entry for secondary organisms. There is considerable reduction in market value due to rotting of leaves.

Early symptoms of infection are rather inconspicuous and easily escape observation. Infection in the beginning is evident on the leaves in the form of very minute, pale-brown spots surrounded by water-soaked area. The spots later turn dark brown and show the bacterial exudate. Occasionally, the bacterium is found to invade the vein edges and run down the petioles through vascular bundles. Under favourable conditions of infection, whole leaf segments become soft and pulpy.

Isolation and Inoculation Studies

The causal organism was isolated by the dilution poured plate technique using potato dextrose agar medium. Isolations from the young pale-brown lesions as well as from those showing limited vascular infection gave in pure culture a bacterium forming smooth, glistening yellow colonies characteristic of *Xanthomonas* species. Single colonies were sub-cultured on to slants of the same medium, on which a copious, slimy yellow growth was observed after 48–72 hours.

Pure culture of the organism was used to inoculate disease-free plants. Young seedlings as well as coriander plants up to flowering stage were sprayed with the bacterial suspension from 48 hours old culture. The inoculated plants were incubated for 12 hours under moist chamber, after which they were transferred to glass-house for further observations. First symptom of successful infection was noticed on inoculated plants after 10 days, appearing as brown specks on the leaves and vein edges. Re-isolations made from these infection spots yielded a culture identical with the original isolate.

With the pathogenicity of the culture established, further experiments to study the biochemical characters as well as infection behaviour of the pathogen were undertaken. The host range of the bacterium was studied by cross-inoculating hosts closely related to coriander. Ten plants were used in each case. The results of these inoculation experiments are presented in Table I.

TABLE I

Results of cross-inoculation of Xanthomonas *species from coriander on other Umbelliferæ*

Host	Infection behaviour
Coriandrum sativum L. ..	Severe infection
Fœniculum vulgare Gaertn. ..	Severe infection
Daucus carota L. ..	No symptoms
Carum copticum Benth. ..	,,
Cuminum cyminum L. ..	,,
Peucedanum graveolens Benth. ..	,,
Pimpinella sp. (Hort. var.) ..	,,

From these studies it became evident that besides coriander, the natural host, the bacterium is capable of infecting also the fennel (*Fœniculum vulgare*) with equal severity, in artificial inoculation experiments. On the much dissected leaves of the fennel, infection extends as pale water-soaked streaks causing severe blighting of the shoots.

With the other umbelliferous hosts, attention was chiefly focussed on the reaction behaviour of carrot in order to ascertain the relationship of the organism to *Xanthomonas carotæ* (Kendrick) Dowson. Seedlings of the commercial carrot varieties "Goldenheart" and "Oxheart" as well as of four indigenous varieties were inoculated with vigorously growing cultures of the organism. In repeated trials, infection symptoms were observed only on the coriander leaves, while the carrot seedlings remained healthy. This indicated that the organism was different from *Xanthomonas carotæ* which is so far not known in India.

CULTURAL AND PHYSIOLOGICAL CHARACTERS

The bacterium is a short rod with rounded ends, occurring mostly single or in short chains, 1·3–2·0×0·5–0·9 μ, gram negative, capsulated, non-acid fast and motile by polar flagellum. No involution forms have been observed.

The organism makes a profuse growth on various media like potato-dextrose agar, nutrient agar and yeast glucose chalk agar forming smooth bright yellow colonies, with translucent or opaque centres. Slants of these media when inoculated with a loopful of culture get completely covered with copious, butyrous, yellow slime within 72 hours when incubated at 28–30° C. The stock cultures have been satisfactorily maintained for over four years on these media, particularly the yeast glucose chalk medium.

Good growth of the bacterium has been observed on various other synthetic or semi-synthetic media also. Czapek's agar and Patel's sodium taurocholate peptone agar (for selective isolation of *Agrobacterium tumefaciens*) also supported very copious growth of the pathogen.

Nutrient broth was clouded with moderately flaky sediment after 48 hours.

Diastatic activity on starch-agar plates was strong resulting in a digested zone of 25 mm. in 8 days around the colony. Moderate liquefaction of gelatin and digestion of casein were observed in petri plate cultures. Milk was rapidly peptonized and the colour of litmus reduced. Ammonia was liberated when cultured in peptone water. Hydrogen sulphide production was also present in traces in such cultures. Tests for indole production from tryptophan containing medium also gave negative results. Nitrates were not reduced to nitrites in synthetic medium. M.R. and V.P. tests were also negative.

A wide range of carbohydrates were utilised by the organism grown in synthetic medium with the production of acid but no gas. In media containing dextrose, lactose, sucrose, maltose, mannitol, glycerol and dextrin, acid was produced after 5–6 days. Salicin and dulcitol failed to support good growth of the organism.

The bacterium is strictly aerobic and is fairly tolerant to a wide range of pH variations in the medium. A concentration of 2–3% sodium chloride in the medium markedly limited the growth with complete inhibition at 4% concentration. The thermal death-point was $\pm$ 54° C.

PATHOLOGICAL ANATOMY

Microtome sections revealed that the entry of the pathogen is through stomata and infection is confined chiefly to parenchymata. Infection through

the vein-endings causes the bacterium to become vascular and run down the veins for short distances on the leaf surface. Systemic infection has never been observed.

Taxonomy and Nomenclature

The bacterial pathogen under study is closely allied to *Xanthomonas carotæ* (Kendrick) Dowson which has been reported to parasitise only *Daucus carota* L.[1, 2] It, however, differs markedly in its not being pathogenic to carrots as well as in its strong diastatic activity, which character has been reported to be absent from *X. carotæ*.

The bacterium is presented as a new species under the name of *Xanthomonas corianderi* with the following technical description:—

Short rods with rounded ends, 1·3–2·0×0·5–0·9 μ, gram negative, capsulated, non-acid fast, without endospores, polar-flagellated; butyrous bright yellow colonies with translucent or opaque centres formed on various nutrient media; starch rapidly hydrolysed while gelatin moderately liquefied and casein partially digested; milk peptonized and litmus reduced in litmus milk medium; ammonia and hydrogen sulphide liberated from peptone water; indole not produced and nitrates not reduced; M.R. and V.P. tests negative; acid without gas from various carbohydrates except salicin and dulcitol; aerobic; thermal death-point 54° C.

Hab. : Pathogenic on leaves of *Coriandrum sativum* L. and infecting *Fœniculum vulgare* Gaertn., also in artificial inoculation experiments.

Poona, August–October 1960.

Summary

An undescribed *Xanthomonas* species (*X. corianderi*) inciting leaf-spot and blight of Coriander plant is described. In inoculation studies it was found to infect fennel also (*Fœniculum vulgare*). The species is closely related to but distinct from *X. carotæ* (Kendrick) Dowson.

References

1. Elliott, C. .. *Manual of Bacterial Plant Pathogens*, Chronica Botanica Co., Waltham, Mass., 1951, 108–09.
2. Kendrick, J. B. .. "Bacterial blight of carrot," *J. Agr. Research*, 1934, **49**, 493–510.