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SYMPTOMATOLOGY AND ETIOLOGY OF BACTERIAL BLIGHT OF CASSAVA (*MANIHOTESCULENTA* CRANTZ)*

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Cassava, is affected by various pathogens, but the bacterial blight is considered to be the most destructive disease. The incidence of bacterial blight is one of the factors which limits cassava cultivation and its production, (Costa, 1940; Lozano and Sequeira, 1974; Lozano, 1975). The disease was first observed in Kerala by Parly *et al*. (1975). Since then, it has been observed from other parts of Kerala and also from the Kanyakumari District of Tamil Nadu. The present study reports the symptomatology and etiology of the disease.

Materials and Methods

Infected plants were collected from the Instructional Farm, College of Agriculture, Vellayani Kerala and the pathogen was isolated on Potato-Sucrose-Peptone Agar medium (PSPA), The bacterium was purified by the streak plate method and the culture was stored in sterile distilled water under laboratory conditions. Isolates of the pathogen were collected from different localities and maintained. Pathogenicity of the isolates was tested by using a suspension of 72 hour old actively growing culture of the bacterium in sterile distilled water (1 x 10^9 cells/ml). Cross inoculations were conducted with *Pseudomonas solanacearum* E. F. Smith isolate from wilted tomato and the isolate obtained from cassava under glass house conditions. Two month old seedlings of tomato were inoculated by the leaf axil method and cassava plants (two month old) were inoculated by smearing the inoculum on the injured lower surface of the leaves. A susceptible cultivar of cassava, H-165, was used for the studies. The morphological, physiological and biochemical characters of the bacterium were studied on PSPA medium as perthe standard methods (Anon. 1957; Dye, 1962}

Results and Discussion

The bacterium isolated on PSPA medium from infected cassava plants was identified as *Xanthomonas manihotis* and its pathogenicity was established by artificial inoculation. The plants showed wilting of leaves within 4–8 days of inoculation. The isolates collected from different localities also were found to be equally pathogenic and virulent and produced typical symptoms. Tomato isolate failed to produce any symptoms on cassava while *Xanthomonas manihotis* produced necrosis at the inoculated region and wilt-like symptoms in tomato. However, the wilt symptoms were not typical as those caused by *Pseudomonas solanacearum.*

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Initial symptoms of the disease appeared as loss of turgidity of one or two mature leaves near the apical growth followed by their rapid v ilting and shrivelling (Fig. 1) As the disease progressed the petiole of leaves turned brown to dark brown and all the fully opened leaves wilted, except the immature, unopened leaves (Fig. 2). The wilted leaves drooped and remained hanging on to the stem for sometime (Fig. 3). Later, the wilted leaves shed, leaving a bare stem, except for a small cluster of young, immature leaves at the apex. As the wilting advanced, the non-lignified terminal apical portion of the stem wilted resulting in the drying up of the bud. Gradually, the stem dried up from the tip downwards. Though the apical growth was checked due to infection, development of the stem was observed (Fig. 4) These sprouts also get subsequently infected and wilted. Bacterial ooze could ho observed from the cut ends of the stem as well as tubers of the affected plants.

If the stem was cut longitudinally and examined, vascular discoloration could be observed whch was more pronounced towards the basal portion. Tubers of affected plants initially showed typical brawn to black discolouratian of the necrosed vascular strands running longitudinally (Fig. 5). The rind of the affected tubers remained apparently healthy even after complete rotting of the internal tissues and often produced fresh fibrous roots.

The bacterium is a slender gram negative rod with a single polar flagellum. It is aerobic, fast growing and formed no pigments. The optimum temperature and pH for growth were 30—32° C and 6.5—7 respectively. The isolate produced ammonia, lipase, tevan, catalase, H_2S, arginine hydrolase, but failed to produce indole, urease, tyrosinase, and acetcin. Milk was turned alkaline with peptonization but without curd formation. The bacterium reduced litmus mllk. It did not utilize asparagine as the sole source of carton and nitrogen. The isolate failed to produce non—water soluble and water soluble pigments in yeast—glucose—chalk agar medium and Kings' medium, respectively. The bacterium hydrolysed srarch, arginine and liquefied gelatin, but gave negative methyl red and nitrate reduction tests.

Of the 20 carbon compounds tested, glucose, galactose, fructose, mannose sucrose, dextrine and pectin were utilised with weak acid production. The growth of the bacterium was poor on rhamnone, galaclose, ribose and raffinose. No acid was produced from arabinose, rhamnose, xylose, raffinose, glycogen, inulin, adonitol, dulcitol. amygdalin, salicin and inositiol.

There was no variation in the virulence of the pathogen isolated from different localities. This finding is in agreement with the observation of Lozano and Sequeira (1974) and Maraite and Meyer (1975) Cross inoculation tests showed that cssava isolate produced wilting in tomato though the symtoms were not typical. Cassava blight bacterium has been reported to be host specific by Arene [1974] and Leu [1976]. Moreover, the disease has been observed in species or varieties of the

Fig. 1 Early symptoms of Cassava blight

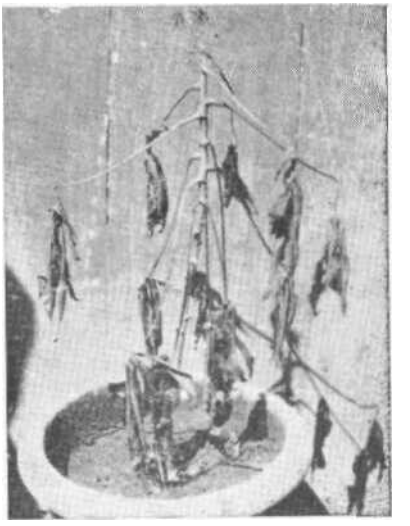

Fig. 2 Symptoms showing wilting of leaves with immature, unopened healthy leaves at the top

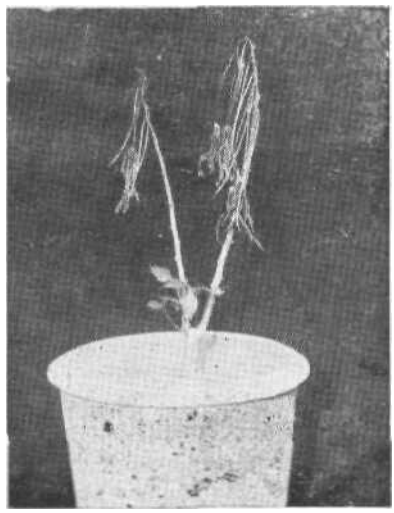

Fig. 3 Advanced stage of the disease showing drooping of the blighted leaves

Fig. 4 Development of new sprouts from the base of the affected stem—note the "Candle-symptoms"

Fig. 5 Tuber infection showing vascular discolouration

genus *Man/hot* only [Bondor, 1915; Amaral, 1942; Burkholder, 1942]. Bradbury [1975] reported that attempt to infect cassava with strains of *P. solanacearum* from other hosts gave negatve results This is in agreement with the findings of the present study on cross inoculation.

Maraits and Meyer (1975) described the disease as the "Candle disease" of Zaire. They reported that angular leaf spot, blight and wilting, are caused by *Xanthomonas manihotis*. Lozano (1975] reported that the symptoms of tne disease are characterised by angular leaf spot and blight, wilting, die-back, gum exudation and vascular necrosis of stem and roots. In the present study, symptoms such as angular leaf spot and gum exudation were not observed. However, the symptoms may be due to genetic variation of the pathogen or due to the climatic and soil factors. This phenomenon of symptom variation has also been observed by Maraite and Meyer (1975).

The identity of the pathogen was established on the basis of physiological and biochemical characters and were comparable with those reported by Lozano and Sequeira (1974), Dye and Lelliot (1974) and Leu (1976). However, Dye *(1956)* reported that the physiological characters were variable even among the isolates of the same species of bacterium

Summary

The bacterial blight of cassava was observed in Trivandrum, Kerala, during 1975 and since then its sporadic incidence was reported form other regions also. The symptoms manifested as blighting of leaves, defoliation, die-back, necrosis of stem, decay of roots (tubers) and wilting of plants. The causative bacterium was isolated and its pathogenicity established by artificial inoculation. Based on the morphological, physiological and biochemical characters of the bacterium and the symptoms produced by it, the pathogen causing the blight of cassava was identified as *Xanthomonas manihotis* (Arthaud-Berthet) Starr.

സംഗ്രഹം

വെള്ളയാണി കാർഷിക കോളേജിലെ [illegible] കേരളത്തിന്റെ മറ്റ് സ്ഥലങ്ങളിലും H 165 എന്ന മരച്ചീനി ഇനത്തിൽ ഒരു പുതിയ രോഗം കാണുകയുണ്ടായി. ഇതേ രോഗം തന്നെ തമിഴ്നാട്ടിലെ കന്യാകുമാരി ജില്ലയിലും കാണുകയുണ്ടായി. ചെടിയുടെ പൂർണ്ണ വളർച്ച പ്രാപിക്കാത്ത കുരുന്ന് ഇലകൾ ഒഴിച്ച് ബാക്കിയുള്ളവ വാടി കൊഴിഞ്ഞ് പോകുന്നു. തുടർന്ന് കിഴങ്ങുകൾക്കുള്ളിലുള്ള നാളിവ്യൂഹങ്ങൾ കറുത്തും മുറ്റിയ തണ്ടിനകത്തുള്ളവ കടുംതവിട്ടു നിറത്തിലും ക്രമേണ ആയിത്തീരുന്നു. രോഗം മൂർച്ഛിക്കുന്നതോടെ, കിഴങ്ങുകൾ ചീഞ്ഞ് ഉപയോഗശൂന്യമാവുകയും ചെടി ഒന്നാകെ വാടിപ്പട്ടുപോകുകയും ചെയ്യുന്നു.

രോഗലക്ഷണങ്ങൾകൊണ്ടും രോഗകാരകജന്തുക്കളുടെ ചില സ്വഭാവ വിശേഷങ്ങളെ ആധാരമാക്കിയും സാന്തോമോണാസ് മാനിഹോട്ടിസ് എന്ന ബാക്ടീരിയ ആണ് രോഗഹേതുവെന്ന് കണ്ടുപിടിക്കുകയുണ്ടായി.

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