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Perspective

Ecological Diversity and Parasitism of *Xanthomonas* Species

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DESCRIPTION

Microbial diseases of plants caused by viruses, bacteria, fungi, or protozoa, are of ecological and economic importance. Almost all pathogenic bacteria develop mostly in the host plant as parasite, on the plant surface specially buds, as epiphytes and partly in plant debris or in the soil as saprophytes. Bacteria can infect all plant parts. Unlike fungi, bacteria must find a natural opening for entry. Bacteria move between plant cells and secrete substances that degrade plant cell walls so the contents can be utilized. Some produce enzymes that break down plant tissue, creating soft rots or water-soaking. Bacterial leaf spots appear different than fungal ones due to their intercellular movement. Veins often limit the development of a lesion, so they appear angular, irregular, not round. The genus *Xanthomonas* is a diverse and economically important group of bacterial pathogens, belonging to the gamma-subdivision of the Proteobacteria consist of yellow pigmented bacteria almost all being plant pathogen. The genus includes a small number of species one of these *Xanthomoms campestris*, is divided into 120 closely related forms called pathovars. Pathovars are distinguished by their plant host range generally one pathovar can attack only a narrow of related plants. Species and pathovars of *Xanthomonas* have been reported to cause disease in at least 124 monocotyledons and 268 dicotyledons. Species of *Xanthomonas* infects a large numbers of plants which include wild plant, ornamental plant, crop plant etc. Species of *Xanthomonas* incites a wide range of symptoms in the host plant. A number of diseases of crop plant are caused by species of *Xanthomonas*. These species comes different type of symptoms on different economical important crop plant, some of the symptoms include leaf blight, wilt, and seedling Rot, leaf spot or streak etc. under highly favourable climatic conditions, severe blighting of plants occurs. Bacterial blight or blackann of cotton caused by *X axonopodis pv. malvacearum*, is an important and potentially destructive bacterial disease worldwide and a serious disease in most upland cotton growing areas of the world Yield losses have been recorded to be in general, between 10% to 30% or more in Asia. The earliest symptoms is found on the seedling cotyledons in the form of water soaked circular lesion which later enlarge to become irregular and brown, causing distortion and withering of the cotyledons. The disease is characterised by angular, waxy and water soaked lesions on the leaf, stem and boll tissues, which gradually turn to brown, necrotic areas. Bacterial canker is one of the most destructive diseases of citrus. The disease is caused by *Xanthomonas axonopodis pv. citri* and leads to defoliation, and premature fruit drop of citrus plant. In India, citrus occupies third position among fruits after mango and banana and canker is one of the major constraints of its cultivation. Citrus canker was first reported from Punjab. The diseased plants are characterized by the occurrence of conspicuous raised necrotic lesions that develop on leaves, twigs and fruits. Lesions can be detected by drawing the fingers over the surface of infected tissues. On leaves, first appearance is as oily looking, 2-10 mm circular spots, usually on the abaxial surface. Lesions are often similarly sized. Later, both apidermal surfaces may become ruptured by tissue hyperplasia induced by the pathogen. On leaves, stems, thorns and fruit, circular lesions become raised and blister-like, growing into white or yellow spongy pustules. Bacterial blight of pomegranate caused by *X axonopodis pv. punicae*, once deemed as a disease of minor importance, became a serious threat for pomegranate production in recent years. The disease assumed its severity in all the growing areas of Maharashtra, Karnataka and Andhra Pradesh resulting severe yield losses both in terms of quality and quantity. The symptoms of bacterial blight on leaves appear as necrotic spots surrounded by chlorotic halos with translucent water soaked appearance. Under severe infections, leaves became distorted and shed off. Fruits also infected with water soaked spots in the earlier stages, later became dark brown, slightly raised from the surface with oily appearance. In many cases, spots were restricted on leaves by veins, resulted into linear stripes. Tissue necrosis and defoliation occurred in advanced cases of infection. On petals of flowers, small, brown, water soaked spots were seen, which later became black and bigger in size. Symptoms were also noticed on immature fruits as small, pin head like, circular with dull green colour, which later turned to deep brown or black with yellowish zone surrounding the spots. As the disease advanced, spots on fruits coalesced together and formed irregular lesions as a result; skin of the fruit became rough. Originally, each variant of the

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genus *Xanthomonas* showing a different host range or producing different disease symptoms was classified as a separate species, which can be described as the new host-new species method. This led to a complex genus that finally contained more than 100 species. Later on, 140 pathovars have been defined within the genus *Xanthomonas*. Several attempts have been made to classify pathovars and strains by using alternative features of the pathogen. Serological test, fatty acid profiling, genomic and plasmid DNA analysis and protein analysis have been used to classify pathovars and strains of different species. The ecology of *Xanthomonas* involves the mutual relationship of the bacterium with biotic and abiotic environment. Special environmental conditions are also involved in the disease epidemiology of the bacterium such as temperature; relative 3 Introduction humidity and rainfall are play the important role in disease development. The weather parameters that significantly discriminated between disease increased categories were the relative humidity higher than 90%, the temperature and rainfall. The bacterium is favoured by 70% relative humidity for entry into the host. The diversity among *Xanthomonas* species has been characterized by using different methods, including physiological tests, biochemical test phage typing, plasmid profile, probe analysis, serological approaches and many molecular methods. Many different PCR genetic fingerprints are used in identification and characterization of the genetic diversity of phytopathogenic bacteria: AP-PCR (Arbitrary Primed PCR); RAPDs (Randomly Amplified Polymorphic DNA); rep-PCR (repetitive sequence-based PCR) and AFLP (Amplified Fragment Length Polymorphism). Although the PCR based DNA fingerprinting is a fast reliable and comparatively low cost method to study genetic diversity of bacteria its effectiveness depends on primers chosen for analysis and quality of DNA. There are many highly conserved repetitive DNA sequences present in the genome of gram negative bacteria and that can be used for study of genetic diversity of bacteria employing PCR with different primers homologous to repetitive sequences named as rep-PCR, BOX and ERIC-PCR primers are conserved. Rep-PCR-based approach is one of the important tools to evaluate genetic diversity of bacterial plant pathogens. This method offers quick, valid and reproducible results making it an important tool for bacterial identification and classification. Rep-PCR has been showed be a well-recognized technique to establish genetic diversity of bacterial populations especially in *Xanthomonas*. In a relationship of Parasitism, the population that benefits the parasite derives its nutritional requirements from the host which is harmed. The host parasite relationship is characterized by relative long period of contact, which may be directly physical or metabolic. Usually, but not always, the parasite is smaller than the host. Parasitism results in a reduction of host population density that then allows for the accumulation and renewal of the environmental resources being utilized by the host.

CONCLUSION

Species of *Xanthomonas* becomes intimately associated with a plant and multiplies or grows at the expense of the plant. The removal of nutrients and water from the host plant usually reduces efficiency in the normal growth of the plant and becomes detrimental to the further development and reproduction of the plant. In many cases, parasitism is intimately associated with Pathogenicity as the ability of the parasite to invade and become established in the host generally results in the development of a diseased condition in the host. Successful infection and bacterial multiplication in the host tissue often depend on the virulence factors secreted including adhesins, polysaccharides, LPS (Lipopolysaccharide) and degradative enzymes. One of the key pathogenicity factors is the type III secretion system, which injects effector proteins into the host cell cytosol to manipulate plant cellular processes such as basal defense to the benefit of the pathogen. Keeping all these aspects in view, the investigation was undertaken with the following objectives.