

## Biological Control of Bacterial Diseases of Plants in Nigeria: Problems and Prospects

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**Abstract:** Plant pathogenic bacteria cause serious problems to farmers in Nigeria, and because they tend to be thermophilic in nature, they affect virtually all-economic crops cultivated in Nigeria. Several crops including vegetables, root and tuber crops, tree crops and other industrial crops are highly susceptible to bacterial infection. In fact as of now, tomato cultivation in the humid forest has been abandoned due to the activities of tomato wilt caused by *Ralstonia (Pseudomonas) solanacearum*. While cassava bacterial blight caused by *Xanthomonas campestris* pv *manihot*'s still remain a problem in the cassava growing region of the country. The cultivation of Kenaf in a large scale for industrial uses has not been visible because of the activities of the seed borne pathogen *Pseudomonas syringae* pv *syringae* which contributed to the low viability of its seeds. The cultivation of cowpea which, is the only source of cheap protein for the teaming populace in Africa, is now under a serious threat by the activities of *Xanthomonas campestris* pv. *vignicola* the causal agents of bacterial blight Of all the control measures available to farmers, biological control is one of the most appropriate because it is the highly environmentally friendly. Several efforts have been made by scientists to provide suitable biological control measures for the managements of bacteria plant pathogens. However, several factors limit the research activities in biological control and the adoption of the research findings. The paper reports the problems and prospects of biological control of bacterial diseases of plants in Nigeria.

**Key words:** Biological control, bacterial diseases, Plant pathogenic bacteria

### INTRODUCTION.

A wide range of food crops and ornamental plants in Nigeria are susceptible to diseases caused by bacteria. Bacterial plant diseases are extremely difficult to control and often result in sudden, devastating financial losses to farmers. Several crops including vegetables, root and tuber crops, tree crops and other industrial crops have been devastated by bacterial pathogens<sup>[1,2,3,4,5]</sup>. In fact as of now, tomato cultivation in the humid forest of western Nigeria has been abandoned due to the activities of tomato wilt caused by *Ralstonia (Pseudomonas) solanacearum*. While cassava bacterial blight caused by *Xanthomonas campestris* pv *manihot*'s still remain a problem in the cassava growing region of the country<sup>[2]</sup>. Bacterial blight of cowpea caused by *Xanthomonas campestris* pv *vignicola* has become the most important bacterial diseases of cowpea in the sudan Savanna part of Nigeria<sup>[6]</sup>. The cultivation of Kenaf in a large scale for industrial uses has not been visible because of the activities of the seed borne pathogen *Pseudomonas syringae* pv *syringae* which contributed to the low viability of its seeds<sup>[7]</sup>. Other bacterial diseases of crop

of economic importance in Nigeria includes *Erwinia carotovora* var *carotovora* infecting cassava root and yam tubers both in the field and in storage<sup>[5,4]</sup>.

*Xanthomonas citri* has been found associated with the fruit canker, tan leaf spot and bacterial ooze from infected stems in southwestern Nigeria<sup>[8]</sup>. Host range studies indicated that Tangerllo, Sweet Orange, Grape and Lime were susceptible to induction of necrotic lesion and canker by the bacterial pathogen. The disease is now devastating citrus plants in the humid forest of Nigeria.

In Nigeria, bactericides are very scarce and most fungicides available do not control bacterial disease. Marcia *et al.*,<sup>[9]</sup> reported that bactericide streptomycin only controls surface-borne blight bacteria but not internally borne blight bacteria pathogens. Due to none availability of synthetic chemicals for controlling bacterial diseases of crops in Nigeria farmers often incures huge losses on crops infected with these pathogens.

In the 1960s agricultural chemicals were found to be, responsible for environmental pollution, present in food chains and capable of inducing pest resistance. Pesticides are also very expensive to produce and

register for use. With the increasing concern about the use of pesticides in agriculture, there is the need to develop alternative plant protection strategies<sup>[10]</sup>. Some pesticides have lost their effectiveness because of the development of resistant pathogens<sup>[2]</sup>. The perceived negative effects of fungicides bactericides and pesticides on agricultural land and water, and their possible toxicity to man and animals, has resulted in the consideration of more environmentally friendly control measures. Biological control of plant diseases lacks most of the limitations of chemical pesticides.

However, biological control of plant diseases has been used in the management of plant pathogens generally<sup>[12,13,14]</sup>, as been said about its potential in the control of bacterial diseases of crops<sup>[15]</sup> hence this paper present the present status of the biological control of bacterial diseases of plants in Nigeria: Problems and Prospects

**Biological Control of Plant Diseases:** Biological control of disease is the employment of natural enemies of pests or pathogens in the eradication or control of their population. It could also be inform of induction of plant resistance using non-pathogenic or incompatible micro-organisms. Over the years farmers in Nigeria has employed the use of composted organic materials such as plant debris and animal manure to add nutrient to the soil in other to increase it fertility. According to Muhammad *et al*<sup>[16]</sup> use of composted organic materials do not only improves plant growth but also makes them less prone to infections by soil inhabiting pathogens. Krause *et al.*,<sup>[15]</sup> ported that Rhizobacteria from composted suppress the severity of bacteria leaf spot of Radish.

However, this biological control method only suffices for backyard farming where household waste (composts) is used as manures. Resulting from success recorded from the backyard farming activities, several researches were initiated at research centers and Universities on the use of composted agricultural and industrial wastes to suppress plant diseases of economic plants<sup>[16,17,18,19]</sup>.

The aim of these researches was to identify the microbes responsible for the disease suppression and subsequent use of such in biocontrol. However, despite the effort, the result only gave lights to the use of some bacterial such as *Bacillus cereus*, *Bacillus subtilis*, *Pseudomonas* spp and some fungus such as *Trichoderma* spp and *Gliocadium* spp in the control of fungal diseases<sup>[16,17,18,19]</sup>.

Bacterial diseases has continued to cause series of set back to farming in Nigeria, efforts to control bacterial diseases of some crops has been very difficult. However, since synthetic chemicals are not available and biological agents have not been fully identified, Research efforts was towards the identification of

vectors of the pathogens which if controlled will reduce incidence and severity of the bacterial diseases<sup>[20,6]</sup>. Amusa<sup>[2]</sup> reported controlling the cassava green spider mite *Mononychellus tanajoa* Bondar.(Acari: Tetranychdae) using *Typhlodromalus. aripo* (Acari: phytoseiidae) significantly reduced the severity of cassava bacterial disease in the transitional forest zone. The knowledge of the fact that microbial toxins like any other toxins can be inactivated or detoxified has been exploited in plant disease (involving toxic metabolites) management based on the fact that reduction in the toxicity of metabolite produced by plant pathogens will confer resistance or tolerance on the host plant. Microorganisms form an exotic source of enzymes, which are capable of inactivating synthetic chemicals that are potentially phytotoxic<sup>[21]</sup> detoxification of pathogen toxin combined with biocontrol efficacy has been well established with *Pantoea dispersa*, which offered an excellent biocontrol against sugarcane leaf scald disease caused by *Xanthomonas albilineans*<sup>[22]</sup>. This host-pathogen interaction, the antagonistic bacterium detoxified albicidin toxin produced by the pathogen.

The most recent methods of managing plant diseases use pathogen produces toxic metabolites which is responsible for disease condition in plants in Nigeria is the use of toxic metabolites of the pathogen in screening for the resistance<sup>[23,24]</sup>. There are a number of instances<sup>[25,26,27]</sup> where the use of culture filtrate and extra-cellular enzymes have proved to be more durable in their effects and these have the advantage of not requiring repeated periodic applications as in the case with chemical fungicides. However, much research work has been done with regards to fungal disease control but research has just commenced on the management of bacteria diseases using this methods.

**Problems:** In recent years, there has been substantial interest in the biological control of plant pathogens especially bacteria world over<sup>[12,28,13,14,29,30,15]</sup>. While biological control agents have been introduced successfully into commercial horticulture for control of crown gall<sup>[31]</sup>, caused by *Agrobacterium tumefaciens*, and fire blight of pear<sup>[32]</sup>, caused by *Erwinia amylovora*, and other bacterial diseases of commercial crops has been effectively managed with biological controlling agents. Biological control of bacterial diseases of crops has not been successvely implimented in Nigeria. Reason for this emmanted from lack of adequate fund to conduct research on biological control of plant diseases. Where funds were made available, it is only for the biocontrol of invertebrate pests (insects). More over research is still being single handedly funded by the Government while Industries and Multinationals like oil companies do not support research in agriculture.

In Nigeria, there has been relatively little or no investment in the development of commercially viable products for biological control, this is due to the high cost of developing, testing efficacy and risk, registering and marketing such product. Considering the peculiar nature of developing nations like Nigeria, the most successful product that will have general acceptability would be one that can be applied using existing machinery or methods with great consideration for the illiterate farmers.

In cases where technologies are imported for implementation, impending problems such as the commercial application and farmers acceptance of biological control methods has to be tackled. Such problems includes diverse range of environmental conditions that are prevalent in Nigeria. This problem can only be overcome by better understanding the environmental parameters that limit biological control. Lack of adequate knowledge of biocontrol often contributes to the downfall of a biocontrol of plant diseases. Hence agriculture extension agents must be empowered with adequate information on biocontrol methods. Knowledge of the biological environment in which the agent will be used and of how to produce a stable formulation is both critical to successful biocontrol

**Prospects:** Nigeria has a population of over 120 million people whose occupations are mostly agrarian. As of now Nigeria is the largest producer and consumers of cassava, yams<sup>[33]</sup> Soghum<sup>[34]</sup>, Cowpea<sup>[35]</sup> beside other numerous horticultural and industrial crops which are all prone to bacterial infections. The high cost of syntethic chemicals if available and the epiphytotic nature of some bacterial diseases of crops has render the cultivation of these crops unprofitable. It is petinent that if maximum yield is to be obtained from the cultivation of economic crops especially in the era of organic farming which is now gaining ground in crop production, an environmentally friendly, less expensive, an affordable and easily adoptable protection practices be put in place. Biological control offers an environmentally friendly alternative to the use of pesticides for controlling plant diseases.

In order to provide food for the teaming populace in Nigeria, it will be impossible if the concept and practice of biological control is not embraced fully, most expecially with regards to arable and vegetable crobs. The federal government of Nigeria is currently encouraging young and abled bodied men including multinationals to go into farming on large scale, these will only be possible where methods of managing diseases of crops have been perfected.

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