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WATERMELON AND SPINACH RHIZOSPHERE DWELLING BACTERIA IN SUBURB MARKETS OF SOKOTO

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ABSTRACT

Rhizospheres of Watermelon and Spinach, in two suburbs of Sokoto (Kwalkwalawa and Ruggar liman), were studied. Nutrient agar was used in cultures while microscopy and biochemical characterization were carried out using the nutrient agar and saboraud dextrose agar for bacterial and fungal respective identification. Streak plate method was used for inoculation of serially diluted soil samples obtained from the respective sampling farm locations. The samples were collected in triplicates for each point. Forty strains belonging to six species including *Pseudomonas syringae*, *P. fluorescence*, *Bacillus subtilis*, and *B. cereus* were isolated. *B. subtilis* had eleven occurrences, *P. syringae* had eleven, *P. fluorescence*, *B. cereus* had nine and seven occurrences each, while *E. coli* occurred two times, only. The most common bacteria on the fields were *B. subtilis*, followed by *Pseudomonas* spp. The least occurring was *E. coli*. The bacterium was absent in sample sites of kwalkwalawa. However, all bacterial species were recorded in all sampling points of Ruggar Liman. Further research into the beneficial activity, or otherwise will help in enabling the farmers know the appropriate steps to take if control is required.

KEY WORDS; Bacteria Sokoto Farming Suburbs, , Watermelon, Spinach.

I. INTRODUCTION

Citrullus lanatus is a member of curcubitaceae, with red or pink flesh which is juicy and eaten raw. *It is* also called Watermelon, and it is a large annual plant with long, trailing or climbing stems (1). Its mineral and nutritional compositions revealed bioactive constituents like iron, crude fibre, phenol, flavonoids, phosphorus, sodium, manganese, potassium, copper, calcium, fat content, lipid, crude ash, zinc and moisture content (2; 3; 4), Factors such as weather conditions Isaket, (1993) (5), unsystematic handling during pre- and post-harvest, packaging or storage could result in oil soaked lesion on watermelon.

Watermelon post harvest deterioration could be caused by black root rot (*Thielaviopsis basicola*), *Alternaria* leaf spot/blight (*Alternaria cucumerina*), bacterial leaf spot *(Xanthomonas campestris*), bacterial rind necrosis (*Erwinia* spp.), belly rot (*Rhizoctonia solani*), angular leaf spot (*Pseudomonas syringaes*), *Fusarium* fruit rot (*Fusarium equiseti*), anthracnose (*Colletotrichum orbiculare*), bacterial soft rot (*Erwinia carotovora*) and bacterial fruit blotch (6; 7; 8; 9; 10). *Amaranthus cruentus* is a common garden species, with stem up to 2m long and leaves 20 – 30 cm long, is used cooked or semi cooked in foods and soups.

Rhizosphere is the region of soils that is subject to influence by plant roots. It is characterized by lots of microbiological activity than the regions of soil away from the roots. The intensity of activity depends on the extent of migration by exudates from the plant root system. The exudates may provide food for antagonists which could suppress the growth of pathogenic microbes. Rhizosphere effect is the overall influence; beneficial or otherwise on soil microorganisms by plant roots (11). The two farming suburbs are not only in contact with the normal rhizosphere activity, but the activity of the surrounding metropolis in times of flood or waste disposals.

II. MATERIALS AND METHODS

Glassware were sterilized using hot air oven at 161° C for 1hr, while inoculation tables, and needles, knives hoes and other equipment were wiped with 70% alcohol. Five samples from each location were mixed evenly and 25 g was taken as representative sample of the replicate point. Nutrient agar was prepared according to manufacturer's instructions and autoclaved at 121° C for 15mins, then allowed to cool to 47° C before being poured in 90mm petri dishes and allowed to solidify in 24 hrs.

Soils were serially diluted and 2 ml of 10^{-5} dilution was used for inoculation. Gram stain was later carried out to identify morphological appearance of the bacteria (whether they are cocci or bacilli, gram negative or positive). This was followed by series of biochemical tests which include; urease, catalase, Indole, starch hydrolysis, TSI, citrate, motility and MR and Voge's Proskauer tests (12). Data obtained was compared with standard Bergeys manual of determinative bacteriology to identify the bacteria.

III. RESULTS AND DISCUSSIONS

The isolated cocci bacteria appeared rod shaped and in chains, while the bacilli were in bundles. *Pseudomonas* species were gram negative, while the *Bacillus* species were gram positive. The presence of both bacilli and cocci groups of bacteria was recorded in some sample sites. While the bacilli were totally absent in Ruggar Liman A. The cocci were also completely absent in Kwalkwalwa A.

TABLE 1: Presence of bacteria from sample sites after gram stain.

Gram stain area	Bacilli	Cocci
Kwalkwalawa A	In chains	Nil
B	In chains	in bundles
C	In chains	Nil
Ruggar Liman A	Nil	in bundles
B	In chains	in bundles
C	In chains	in bundles

TABLE 2: Occurrence of organisms in study areas

Organism	Kwalkwalawa	Ruggar Liman
B. cereus	+ + +	+ + +
B. subtilis	+ + +	+ - +
E. coli	- - -	- + -
P. syringae	+ + +	+ + +
P. fluorescence	- - +	+ - -

The most widely occurring bacteria were *B. cereus and P. syringae, present in all the sample sites. B. subtilis* was also abundant, being absent in only a sample site at Ruggar Liman. However, *P. fluorescence and E. coli* showed very low presence, being available at two and one sample sites, respectively (Table 2). The *E. coli* bacteria were absent in all sample sites of kwalkwalawa and some sampling points of Ruggar Liman, but all species were recorded in Ruggar Liman, with. *B. cereus* and *P. syringae* were recorded in all sampling points of both the Kwalkwalaw and Ruggar Liman farm locations. *B. subtilis* also occurred in all sample points of Kwalkwalaw but was absent in one point of Ruggar Liman but occurring in two of the points. The appearance of *E. coli* points to a possibility of waste contamination around the farming area. However the occurrence is very minute and it is not to an extent to raise alarm.

TABLE 3: Statistical analysis of the bacteria colony obtained from the three areas

Source	DF	SS	MS	F	P
BACTERIA COLONY	3	26.2500	8.7500	0.84	0.520
AREAS	2	2.1667	1.-833	0.10	0.903
Error	6	62.5000	10.4167		
Total	11	90.916			

S = 3.227 R-Sq = 31.26% R-Sq(adj) = 0.00%

Bacillus. subtilis is rod-shaped, and has the ability to form a tough, protective endospore, allowing the organism to tolerate extreme environmental conditions. It has historically been classified as an obligate aerobe, though recent research has demonstrated that this is not strictly correct (13). It is only known to cause disease in severely immunocompromised patients, and can conversely be used as a probiotic in healthy individuals (14). It rarely causes food poisoning (15; 16). In addition to its role as a model organism, *B. subtilis* is used as a soil inoculant in horticulture and agriculture. As a model organism *B. subtilis* is commonly used in laboratory studies directed at discovering the fundamental properties and characteristics of Gram-positive spore-forming bacteria.[7] *B. cereus* may be associated with food poisoning (17; 18).

Odelade and Oladeji (2020) (19) observed that, factors such as weather conditions, unsystematic handling in pre- and post-harvest, packaging or storage could result in oil watermelon contamination. The result tends to agree with the findings that Post harvest watermelon deterioration could be caused by some bacteria and fungi like alternaria leaf spot/blight (*Alternaria cucumerina*), bacterial leaf spot *(Xanthomonas campestris*), black root rot (*Thielaviopsis basicola*). Though they were not isolated but those isolated could have been transferred to the field during planting.

TABLE 4: Statistical analysis of the fungi colony obtained from the three areas

Source	DF	SS	MS	F	P
FUNGAL COLONY	5	88.667	17.7333	1.47	0.281
AREAS	2	13.000	6.5000	0.54	0.599
Error	10	120.333	12.0333		
Total	17	222.000			

S = 3.469 R-Sq = 45.80% R-Sq(adj) = 7.85%

TABLE 5: Biochemical analysis of organisms

Test	*E. coli*	*B. cereus*	*B. subtilis*	*P. syringae*	*P. fluorescence*
Gram stain	G-ve	G+ve	G+ve	G-ve	G-ve
Oxidative reduction	-	+	-	-	+
Indole production	+	-	-	+	-
Methyl red	+	+	+	+	-
Voge's proskauer	-	-	-	-	+
Citrate	-	-	-	+	+
Hydrogen sulphide	-	-	-	-	-
Urease	-	-	-	+	+
Motility	+	+	+	+	+
Starch hydrolysis	+	+	+	+	+
Catalase production	+	+	-	+	+
Nitrate reduction	+	-	-	+	+
Lactose	+	+	+	+	-
Maltose	+	+	+	-	-
Sucrose	+	+	+	-	-

IV. CONCLUSION AND RECOMMENDATIONS

The soils in both farming suburbs contain more of normal soil bacteria, with *B. subtilis* having the largest occurrence while the pathogenic *E. coli* had least occurrence. Soil treatment will be of great benefit to stem the pathogenic bacteria while clean irrigation water should also be made available to prevent any problem that can give rise to contaminations.

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