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Isolation and Counting of Bacteria from Agricultural and Non-Agricultural Soils and the Study of Environmental Factors of the Soil

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Abstarct: The current study aimed to find out the effect of some physical and chemical properties on the biological diversity of bacteria in agricultural and non-agricultural soils, five regions were selected at the University of Baghdad, Al-Jadriyah Complex (College of Agriculture, College of Science for Girls, College of Mixed Science, College of Engineering, College of Veterinary Medicine) during December in winter 2019 to see which areas are more diverse with bacteria, the results of the current study indicated that the values of physical and chemical factors ranged between 7.50 - 7.85 pH and 400 - 1740 microsimens / cm for electrical conductivity and for salinity 0.36 - 1.4%, while the values of nitrate ranged between 196 - 2288 mg / l and phosphate between 0.15 - 5.63 mg / l and calcium ranged between 1.62 - 3.54 mg / l. Magnesium between 0.45 - 1.09 mg / l and sulfate 50 - 11182 mg / l and chloride 2407 - 1133 mg / l and iron 0.18% - 0.48%. Aluminum 0.06% - 0.13%, copper 11.0 - 33.0 mg/L, Nickel 6.1 - 17.8 mg/L, Lead 9.2 - 70.0 mg/L, Cadmium 0.16 - 0.66 mg/L. as for the soil, the percentage of sand ranged between 2.67% - 24.89% and silt ranged between 7.86% - 44.11% and clay values ranged between 11.74% - 12.85%, the soils were classified according to the type of particles that make up them, and the number of types of bacteria diagnosed in the current study was 35 isolates, the genus Sphingomonas paucimobilis was predominant, amounting to 12 species, by 34.29% of the total number of species, then the genus Staphylococcus, which amounted to 4 species, by 11.43%, then the genus pasteurella, it reached 3 species (8.57%), then the genus Pantoeaspp, Aeromonas veronil, serratia Rubidaea and E.Coli (2 species) with a rate of 5.71%, then the genus Psuedomonas fluorescence (3.5%) and 8 unidentified species, the genus Sphingomonas paucimobilis recorded dominance in all study areas except the College of Mixed Science Agricultural soil, the College of Agricultural Soil Engineering and the College of Veterinary Medicine Non-agricultural soils.

1. INTRODUCTION:

1.1. Soil

is the fragile or pubescent surface layer that covers the surface of the soil, it consists of charmed rock materials that have undergone change due to their exposure to environmental factors (including weathering and erosion), biological and chemical, soil is a mixture of organic and mineral components that make it up, soils are also known as earth, it is the material from which the planet Earth on which we live is derived its name, some of the materials that make up the soil in the planet date back to before the third geological era soil [1].

1.2. The Most Important Types of Soil

There are many types of soil, which differ in many characteristics, and the following are some of the most important types of soil:

1.2.1. Sandy Soil (light soil) contains less than 20% of its weight silt and clay, it is well drained and ventilated and has very low water retention [1].

1.2.2. Clay Soil contains at least 30% of its weight clay, it is poorly ventilated but have a field capacity (water retention) and very high nutrients [1].

1.2.3. Loamy Soil (yellow) is the best types and composed of good proportions of sand, silt and clay, it contains more clay, it is defined as clay loamy soil, the amount of silt is predominantly defined as soil loamy alluvial [1].

1.3. Soil Biodiversity

Soil organisms account for only 1% of the total soil mass, these organisms include plants, animals, and microbes, the knowledge of microorganisms in the soil is very important because of the role they play, which may lead to a radical change in soil compounds through the biochemical changes they make, these changes produce the activity of organisms in the form of individuals, countunities, or populations, education includes many types of organisms that vary in size, some of them are seen only using an electron microscope, such as microorganisms, while some are seen with the naked eye, such as earthworms, Microorganisms include viruses, bacteria, algae, fungi, and protozoa [3], Microbiology plays an essential role in maintaining soil fertility and supplying growing plants with their nutritional needs, through its mineralization of organic matter, and its facilitation of nutrients and stabilization of atmospheric nitrogen, the formation of humus, and the secretion of many substances that encourage growth. These microbes also have an effective role in maintaining the biological balance in the universe, through their production of carbon dioxide, which has an atmospheric percentage of about 3 0.0% in volume, during the processes of decomposition of organic matter, which compensates for the deficiency that occurs due to the continuous photosynthesis process, and the decomposition of environmental pollutants and agricultural pesticides and under certain conditions, such as the prevalence of anaerobic conditions in the soil, or the lack of nutrients in it, soil microbes may compete with growing plants for nutrients in the soil, or microbes secrete substances harmful to plant growth, or cause them diseases, thus affecting land productivity, the numbers and types of microorganisms vary greatly, from one soil to another, depending on the composition of the soil, the depth, the type of existing agriculture, and the environmental soil conditions, such as heat, moisture, water, pH, and the soil content of nutrients.

1.4. Bacteria Soil:

the soil contains large numbers of bacteria, the bacterial cell is small in size, rarely exceeding several micrometers in length, compared to extremely elongated filaments or large cells, other microorganisms, the total mass of bacterial cells can account for less than half of the total weight of the total microbial cells in the soil.

The types of soil bacteria have been developed in two main sections:

The first includes soil-inherent species (Indigenous. Autochthonous), the species belonging to the first section settle the soil naturally and permanently, where they multiply in them and contribute very effectively to their biochemical activities, it is characterized by its ability to withstand and resist inappropriate conditions where it can remain static without activity for long periods.

The second includes species that are exotic to the soil (invaders, allochthonous), the second group includes bacteria that reach the soil with rainwater, or by entering diseased tissues, or human and animal waste into the soil, as well as vaccines and bio fertilizers, these species remain alive for a while either in a dormant state or grow for short periods, however, they do not participate effectively in the transformation processes of elements in the terry, nor do they share any kind of mutually effective relationships with other soil microorganisms, it is rare that free bacteria are found in the soil solution, because most cells adhere to the surface of clay and humus granules, it is likely that a large part of the soil microbes are present in the form of separate groups that multiply in the exact locations suitable for them in the soil, it can also be found in the case of distinct lumps accompanying mucous secretions of bacteria, Bacterial cells, soil colloids and clay grains are attracted to each other by the effect of electrostatic attraction of the soil on bacterial cells, this leads to the retention of most bacterial cells in the soil and the small numbers that travel with the water down, the greater this adsorption property, the more it affects the biochemical activities of bacteria [2].

2. Work and results

2.1. Tools used

1. Shovel or pickaxe
2. Plastic bags for sample collection
3. Sensitive balance
4. Soil sieves
5. Test tubes
6. Glass Baker
7. Agricultural media
8. Sterile distilled water
9. Swap
10. Loop
11. Vitek device
12. Incubator

2.2. Works Method

2.2.1. Sample Collection

1. Soil samples were collected from five different sites (College of Science for Girls, College of Mixed Science, College of Agriculture, College of Engineering, College of Veterinary Medicine), for agricultural soil and non-agricultural soil, taking into account taking 3 replicates (R1, R2, R3) for each sample.
2. The sample is taken using a shovel (pickaxe) or a clean spoon after scraping (1) cm from the soil surface and a depth ranging between (5-10) cm.
3. A certain amount of soil is taken, placed in sterile bags and all information is recorded on it (such as soil type, sample location).
4. The bags are transferred to the laboratory for the necessary studies.

2.2.2. Preparation of Agricultural Media

1. Agar Nutrient media: Prepared according to the manufacturer by dissolving 28 g in 1000 ml of sterile water, then sterilized with the locker.
2. Nutritious broth medium: Prepared according to the manufacturer by dissolving 21 g in 1000 ml of sterile water, then sterilized with the locker.
3. Agar Almakonki: Prepared according to the manufacturer by dissolving 51.5 g in 1000 ml of sterile water, then sterilized with the locker.
4. Agar Salmonella Shigla: Prepared according to the manufacturer by dissolving 63.02 g in 1000 ml of sterile water, then sterilized with the locker.
5. Agar Eosin Methylation: Prepared according to the manufacturer by dissolving 26.46 g in 1000 mm of sterile water, then sterilized with the locker.
6. Agar menthol: Prepared according to the manufacturer by dissolving 111 g in 1000 ml of sterile water, then sterilized with the locker.

2.2.3. Bacteria Isolation Method

1. It weighs (1 g) of each of the different models (agricultural soil and non-agricultural soil), add to test tubes a container of 10 ml sterile distilled water, mix well and then leave to precipitate the soil.

2. A series of decimal scaring is made from the soil filtrate, the fourth dilution is taken 1/10000.
3. Dilution 1/10000 per sample is planted on different planting media by sterile spores.
4. Dilution is propagated on 4 types of differentiated, diagnostic and general bacteriophage cultures.
5. The first media is macconkey Agar, which stabilizes the growth of gram-negative bacteria, and this medium is differentiated from lactose-fermenting bacteria (Lac+) that take a pink color and non-fermented lactose (Lac-) that has no color, the second media is mannitol salt agar, a medium that stabilizes the growth of Gram-positive bacteria and is a differential medium between Staphylococcus aurous bacteria whose growth is yellow and other species of Staphylococcus spp, the third media. Eosin methylene blue Agar, which stabilizes the growth of Gram-negative bacteria, and forms a differential medium for the growth of E. coli bacteria, the growth color is phosphorescent green (brilliant green), the fourth media is nutrient agar on which all kinds of negative and positive bacteria grow.
6. The dishes are incubated in the incubator for 24 hours at a temperature of 37, after 24 hours of incubation, different bacterial colonies appeared for each repeater, for each site, and for the different culture media used.
7. Different colonies are elected in each dish, selected colonies are taken and replanted on the medium differentiating between Gram-negative and Gram-positive bacteria for the purpose of initial diagnosis, for E.coli diagnosed directly on the medium, where the colonies appear in a greenish-violet color with a phosphorescent green color (shiny).
8. It is re-implanted by taking a swab from the colony with a sterile tube, it is spread on the growing medium and incubated for 24 hours as well, after the incubation period the growth of colonies appears in the dishes.
9. For the purpose of advanced diagnosis of bacterial isolates, the bacterial isolates were purified by taking single colonies and transplanting them on nutrient agar medium to obtain pure isolates.
10. Cuddled at 37 m for 24 hours, the isolates were then transferred to the laboratory for the purpose of accurately diagnosing bacteria using the Vitek device, part of these samples (isolates) were preserved with 20% glycerol solution at a temperature of minus 50.

2.2.4. VITEK-2 System

It is a system based on the identification of biochemical reactions between the suspended Bukayriyah isolates in their solutions and the media present in VITEK-2 to identify isolates. Bacterial isolates are injected onto McConky agar plates and then incubated overnight at 37°C, one colony is then taken and suspended in the device solution and then the growth of the bacterial suspension is modified using VITEK Densichek (bio Meraux) to fit the standard of 0.5 Mc Farland in 0.45% mZ sodium chloride, then the VITEK 2 ID-GN (Gram Negative) or (Gram Positive) card and bacterial suspension tubes were manually loaded into the VITEK-2 system, then perform the following steps on the software according to the manufacturer's instructions [5]

2.2.5. Determination of Soil Ratio

1. Soil samples are taken and impurities are removed from them and large lumps are crumbled, and it is done on paper or a laboratory dish, so that we get a homogeneous and dry sample.
2. The texture or type of soil is determined by the method of the table of components, weighed (100 g) of each sample using the picker with the sensitive balance.
3. The sample is placed inside the soil sieves for separating the soil minutes, we move the sieves in a circular or vertical manner up and down for a period of (3-5 minutes).
4. Each part of the soil sample is weighed in each sieve separately, taking into account that the total weight of the soil model = the sum of the weights of the 5 parts

5. The percentage of each part is extracted following the following law: Percentage = Weight of the part/total weight of the soil ×100.
6. The type of soil is determined depending on the prevailing percentages (largest) observed through the results table, which shows the percentages of the parts of the soil sample (its components).

2.2.6. Chemical and Physical Measurements (Environmental Factors)

1. pH and EC electrical connection

- Take 50 g of each soil sample and add 100 ml of distilled water
- The pH and conductivity are then measured using the HANNA Instrument pH-EC-TDS meter.

2. Salinity (%)

Salinity was determined based on conductivity values according to the equation given by Mackerethet al., 1978.

Salinity (%) =EC x640x106

3. Calcium (Ca)

Calcium was calculated by the following procedure 2 ml of sodium hydroxide (1N) was added to a 50 ml sample and then shaken well, then 0.1 g of the Murexide indicator was added and shaken well, the solution will have a pink color titration was performed at a scale of 0.01 M EDTA until the color changed from pink to purple [7] (Lind, 1979).

4. Magnesium (mg")

Magnesium from subtraction calculates the results of calcium concentration from total hardness (Lind 1979)[7]

Mg Mg pre liter = 12.16 x (m Eq hardness per liter – m Eq Ca' perlite) m Eq hardness per liter= mg hardness per liter x 0.01998 m Eq

Ca per liter-mg Ca' per liter x 0.0499

5. Phosphate

Active phosphate was measured using the method prescribed by the American Health Association [8] (APHA 1985) by adding 8 ml of an HVAC reagent consisting of (molybdic acid, ascorbic acid and tri (valentine) to 50 ml of the candidate sample, the collector is formed to give a blue-colored solution that has not read the absorption of the solution using a spectrophotometer Shimadzu Corp. model 680 UV spectrometer at a wavelength of (810) nm.

6. Sulfate

The sulfate was calculated on the basis of the method determined by the American Health Association (1985, APHA)[8] by taking a certain volume of sample and diluting it to 100 ml with distilled water, and add 5 ml of reagent solution consisting of glycerin, hydrochloric acid, ethyl alcohol, sodium chloride, distilled water) and (0.15) g of barium chloride with continuous stirring for 4 minutes and at a constant speed, solution absorption was measured using the Schimadzu 680 UV spectrometer and at a wavelength of 420 nm

7. Chloride

Chloride was calculated on the basis of the method prescribed by the American Health Association [8] (APHA, 1985), where 100 ml of the sample is added after adding 1 ml of potassium chromate reagent 4K2CrO against the standard silver nitrate AgnO3 (0.14) molar solution and according to the following equation:

Mg / 1 CI = (A – B) ×N ×35450 /ml

A: Sample size, B: mm Standard sample size (blank) N: Standard silver nitrate

8. Nitrates

Nitrates estimated at 25 g from the soil sample to 50 ml of distilled water shake for 5 minutes, then leave to settle for a few minutes and then filtered by filter paper (No. 64), add 1 ml of HCl to the sample, the solution is measured in curium cm1 using a wavelength of 220 nm.

9. Aluminum

1. Take 12.5 g of soil and add 25 ml of distilled water shake for 5-10 minutes and then filter it using filter paper (No. 64).
2. Take 0.1 g of Ascorbic acid and add (100 ml) of distilled water this solution is prepared immediately.
3. We take (10 ml) of (Stock dye solution) and complete it to (100 ml) distilled water to prepare (working dye solution) this solution can remain for 15 days.
4. Add (1 ml) sulfuric acid (N0.02) and (1 ml) of ascorbic acid and mix well.
5. Add (10 ml) of Sodium Acetate Buffer.
6. Add (5 ml) of (working dye solution) and complete the volume to (50 ml) and read at a wavelength of 535 nm.

10. Heavy Metals (Fe, Ni, Pb, Cd, Cu)

Using an atomic absorption spectrometer takes 1 g of soil in a 300ml titration tube digestion, then add 3 ml 3HNO concentrate placed on the hot plate then we slowly increase the temperature to about 145 ° C for one hour and then add 4 ml of 4HCIO concentrate, then heat it to 240 ° C for another hour and then we lift the tubes from the digestion mass and then let the tubes cool to room temperature and then filter through the filter paper (No. 42) and raise it to a size of 50 ml and is determined (Ni, Pb, Cd, Cu, Fe) by atomic absorption spectrometry.

3. Calculations and Results:

3.1. Bacterial Isolation Results

The various bacterial isolation processes led to the isolation of 35 bacterial isolations, including 22 isolated from agricultural soil, and 13 from non-agricultural soil, the results of the agricultural soil for the five sites were as follows:

Table 1: The results of the advanced diagnosis of bacteria in agricultural soil in the five samples are as follows:

Site	Duplicates	Bacteria Number	Types of bacteria
1- College of Science for Girls	R1	3	*Staphylococcus pasteurella*, unidentified
	R2	2	‹*Sphingomonas paucimobilis*
			Staphylococcus
	R3	2	*Staphylococcus* ‹*Sphingomonas paucimobilis*
2- College of Agriculture	R1	1	*Sphingomonas paucimobilis*
	R2	1	*Sphingomonas paucimobilis*
	R3	1	Unidentified
3- College of Mixed Science	R1	No growth	
	R2	No growth	
	R3	No growth	
4- College of Veterinary Medicine	R1	3	*Pantoea spp. Sphingomonas paucimobilis, unidentified*
	R2	3	*Pantoea spp. Sphingomonas paucimobilis,*

			unidentified
	R3	3	*E.Coli, Aeromonas veronil, Unidentified*
5- College of Engineering	R1	1	*Unidentified*
	R2	1	*Unidentified*
	R3	1	*Aeromonas veronil*

Bacteria in the soil:

The number of bacteria species diagnosed in the current study was 35 isolates, with the genus Sphingomonas paucimobilis predominant, reaching 12 species and by 34.29% of the total number of species, then the genus Staphylococcus, which reached 4 species, by 11.43%, then the genus pasteurella, which reached 3 species, by 8.57%, then the genus Pantoea spp, Aeromonas veronil, Serratia Rubidaca and E Coli, 2 species (5.71%), Psuedomonas fluorescence (3.5%) and 8 unidentified species.

* The lowest rate of bacteria was recorded in the College of Mixed Science Agricultural Soil and the College of Veterinary Medicine Non-agricultural soil, as there is no final growth and the highest rate of 9 types in the College of Veterinary Medicine Non-agricultural soil

3.2. Soil Texture:

To determine the soil texture of the different samples, the weight of the soil parts (gravel, sand, silt, clay) was measured, and the results were as follows:

Table 3: Soil Measurements

Site	Gravel weight (g)	Sand weight(g)	Alluvial weight (g)	Clay weight (g)
1- College of Science for Girls non-agricultural soil	25.48 g	13.95g	22.47g	38.10g
2- College of Science for Girls Agricultural soil	24.29g	24.89g	39.08	11.74g
3- College of Science Non-agricultural soil	15.84g	17.04g	27.74g	39.38g
4- College of Science Agricultural soil	11.62g	17.86g	35.79g	34.73g
5- College of Agriculture non-agricultural soil	16.62g	18.74g	44.11g	20.52g
6- College of Agriculture Agricultural soil	14.32g	12.96g	33.70g	39.02g
7- College of Veterinary Medicine is agricultural soil	3.68 g	3.34g	7.86g	85.12g
8- College of Veterinary Medicine Agricultural soil	3.47 g	2.67g	10.81g	83.05g
9- College of Engineering Non-agricultural soil	10.14g	13.58g	34.48g	41.80g
10- College of Engineering Agricultural soil	18.12g	19.22g	34.39g	28.34g

Table 4: The results of the mechanical analysis of the studied soil show the percentage of sand, silt percentage and clay percentage in all samples

Site	% Sand	Silty %	Clay%	Soil texture depending on the highest percentage component
1- College of Science for Girls non-agricultural soil	13.95%	22.47%	38.10%	Clay soil
2- College of Science for Girls Agricultural soil	24.89%	39.08%	11.74%	Alluvial soil
3- College of Science Non-agricultural soil	17.04%	27.74%	39.38%	Clay soil
4- College of Science Agricultural soil	17.86%	35.79%	34.73%	Alluvial soil
5- College of Agriculture non-agricultural soil	18.74%	44.11%	20.52%	Alluvial soil
6- College of Agriculture Agricultural soil	12.96%	33.70%	39.02%	Clay soil
7- College of Veterinary Medicine is agricultural soil	3.34%	7.86%	85.12%	Clay soil
8- College of Veterinary Medicine Agricultural soil	2.67%	10.81%	83.05%	Clay soil
9- College of Engineering Non-agricultural soil	13.58%	34.48%	41.80%	Clay soil
10- College of Engineering Agricultural soil	19.22%	34.39%	28.34%	Alluvial soil

Sand:

It was noted through the results that the percentage of sand ranges between the lowest value of sand recorded in the College of Veterinary Medicine 2.67% for agricultural soil, the highest value was 24.89% in the College of Science for Girls Agricultural soil, during the results, it was found that there were significant differences between some areas of the study, as well as between the same areas between agricultural and non-agricultural soils.

Silt:

The percentage of silt ranged between the lowest value of 7.86% in the College of Veterinary Medicine and the highest value of 44.11% in the College of Agriculture and non-agricultural soil, the results showed that there are significant differences between the different regions, and it was also noted that there are significant differences between agricultural and non-agricultural soils for the same region.

Clay:

The results show the lowest percentage value of clay 11.74% in the College of Science for girls in agricultural soil and the highest value of 85. 12% in the College of Veterinary Medicine in non-agricultural soils, the results of the percentage of clay indicated that there were significant differences in the study areas, in addition, there are significant differences between agricultural and non-agricultural soils for the same areas.

3.3. Environmental Factors

Table 5: Results of chemical and physical factors for the studied areas

Environmental factors																
Salinity %	EC	PH	CL PPm	Al%	Mg %	Ca%	Cu PPm	Cd PPm	Ni PPm	Pd PPm	Fe%	SO4 PPm	PO4 PPm	NO 3 PPm	Site
0.36	571	7.50	1416	0.11	0.81	2.4	11.0	0.28	10.5	9.2	0.35	297	0.15	645	1- Faculty of Veterinary Medicine, non-agricultural soil.
0.47	740	7.6	1420	0.08	0.6	2.06	12.3	0.16	9.0	18.5	0.3	319	4.24	420	2 - Faculty of Veterinary Medicine agricultural soil
0.47	740	7.66	2024	0.12	1.0	2.5	28.3	0.28	17.8	51.5	0.44	1074	1.46	2288	3 - Faculty of Science girls soil non-agricultural soil
0.51	800	7.77	1416	0.09	1.03	2.2	28.0	0.25	15.5	40.5	0.41	393	0.31	460	4 - Faculty of Science girls soil agricultural
1.04	1625	7.68	1420	0.13	1.09	2.26	33.0	0.47	21.3	59.0	0.48	1182	0.31	196	5 - Faculty of Engineering non-agricultural soil
0.57	896	7.53	1274	0.1	0.45	2.33	18.6	0.31	6.1	35.0	0.18	162	5.63	591	6 - Faculty of Engineering agricultural soil
0.54	844	7.74	1419	0.09	1.02	2.38	31.3	0.25	15.4	46.0	0.39	583	2.64	504	7 - Faculty of Mixed Science non-agricultural soil
1.11	1740	7.56	2407	0.06	0.81	1.62	25.8	0.34	12.2	33.1	0.31	708	0.15	730	8- Faculty of Mixed Sciences, Agricultural Soil
0.29	452	7.77	1133	0.07	0.71	3.54	13.5	0.66	12.2	51.5	0.34	124	4.3	270	9 - Faculty of Agriculture non-agricultural soil
0.26	400	7.85	1420	0.11	0.85	2.14	18.6	0.38	15.7	70.0	0.37	50	0.45	207	10 - Faculty of Agriculture agricultural soil

3.3.1. pH

It was noted through the results that the pH values during the current study ranged from the lowest value of 7.50 in the College of Veterinary Medicine non-agricultural soil and the highest value was 7.85 in the College of Agriculture Agricultural soil

2.3.4 Electrical conductivity The lowest value of electrical conductivity in the College of Agriculture Agricultural soil 440 micro Siemens / cm and its highest value 1740 micro Siemens / cm in the College of Mixed Sciences Agricultural soil

3.3.2. Salinity:

Salinity recorded its lowest value in the College of Agriculture Agricultural soil, reaching 0.26%, and its highest value was 1.11% in the College of Mixed Sciences. Agricultural soil

3.3.3. Nitrate:

Nitrates recorded the lowest value 196 in the College of Non-Agricultural Soil Engineering and the highest value of 2288 in the College of Science for Girls Non-agricultural soil

3.3.4. Phosphate:

The lowest phosphate value was 0.15 in the College of Veterinary Medicine in Non-Agricultural Soil and the College of Mixed Science Agricultural Soil and the highest value of 5.63 in the College of Agricultural Soil Engineering

3.3.5. Sulfate:

The lowest sulphate value was 50 in the College of Agriculture and the highest value was 1182 in the College of Non-Agricultural Soil Engineering.

3.3.6. Calcium:

The lowest calcium value was 1.62 registered in the College of Mixed Sciences Agricultural soil and the highest value of 3.54 in the College of Agriculture Non-agricultural soil

3.3.7. Magnesium:

The lowest value of magnesium was 0.45 in the College of Agricultural Soil Engineering and the highest value of 1.09 in the College of Non-Agricultural Soil Engineering.

3.3.8. Aluminum:

The lowest percentage of aluminum was recorded in the College of Mixed Sciences, agricultural soil, 0.06, and the highest value of 0.13 in the College of Engineering, non-agricultural soil.

3.3.9. Chloride:

The lowest value was 1133 in the College of Agriculture and the highest 2407 in the College of Mixed Sciences Agricultural Soil

3.3.10. Heavy Metals:

The lowest value of iron was 0.18 in the College of Agricultural Soil Engineering and the highest value was 0.48 in the College of Non-Agricultural Soil Engineering, the lowest lead value was 9.2 in the College of Veterinary Medicine for non-agricultural soil and the highest value was 70.0 in the College of Agriculture Agricultural soil, the lowest value for nickel was 6.1 in the College of Agricultural Soil Engineering and the highest value was 213 in the College of Engineering Non-agricultural education and the lowest value of cadmium was 0.16 in the College of Veterinary Medicine Agricultural soil and the highest value was 0.66 in the College of Agriculture Non-agricultural soil, the lowest value for copper was 11.0 in the College of Veterinary Medicine in non-agricultural soil and the highest value was 33.0 in the College of Non-Agricultural Soil Engineering.

4. Discussion

4.1. Physical and Chemical Properties:

Changes in the physical and chemical properties of any soil itself are major factors affecting the presence of

1. pH:

pH is expressed in soil acidity and is defined as the negative logarithm of the concentration of active hydrogen ions in soil solution, it directly or indirectly affects the metabolic chemical processes of bacteria and also the pH factor affects the ionic properties of bacterial cells, so it affects the growth of bacteria, (Hydrogen ion also affects the soil by facilitating elements and cationic exchange), as well as the decomposition and bioactivity of organic matter, this value is affected by the type and quantity of clay metals in the soil, and the soil content of organic matter, total carbons and lupus salts, the results of the current study showed that the lowest pH value was 7.50 in the College of Veterinary Medicine in non-agricultural soil and the highest value was 7.85 in the College of Agriculture Agricultural soil, that the PH value in all pH areas in the range 7.50 – 7.85 is generally considered to be neutral pH-loving, where at pH is close to 7, the growth of most groups of bacteria is maximum, and their numbers increase significantly when the rest of the other environmental factors are proven

2. Electrical Conductivity and Salinity:

Conductivity is defined as the true measure of the solvency's conductivity and depends on the temperature and concentration of ions, salinity values are similar in terms of height and fall with conductivity, where the conductivity values were relied on in calculating salinity, which means that the increase and decrease in salinity is due to the same reasons that led to the increase and decrease in electrical conductivity, salinity is also closely related to electrical conductivity and salinity expresses the content of dissolved salts, the results showed that the lowest values of conductivity and salinity were 400 microseism/cm and 0.26% respectively in the College of Agriculture and agricultural soil, it may be attributed between salt concentration and jet plant growth, which may consume nutrients in the form of salt, while the highest values of conductivity and salinity were 1740 microseism/cm and 1.11%, respectively, it may be due to the process of adding irregular fertilizers continuously, which adds a percentage to the soil salts, which accumulate as a result of the continuous evaporation phenomenon from the soil surface, the variation in salinity may be due to the difference in the concentration of calcium ions Ca, magnesium Mg, chlorine CI, and carbonate CO3 in soil solution because they are considered salinity ions.

3. Nitrates NO3:

Nitrates are the oxidizing state of nitrogen and are the most stable, Nitrogen fertilizers are often in the form of urea (4CO (NH) or ammonium root (NH) but undergo a series of chemical and/or biological reactions to settle to a nitrate state (3), Nitrates are found in two sources: Loading External from various human activities using fertilizers, animal fertilizers and industrial waste, and the other Loading Internal as a result of the decomposition of organisms (algae and bacteria) and other living organisms after their death or feces, the results of the current study showed that the lowest value of nitrates is 196 mg / liter in the College of Engineering non-agricultural soil and the highest value is 2288 mg / l in the College of Science for Girls in non-agricultural soil.

4. Phosphate:

Phosphorus is an important nutrient, which is important for the synthesis of nucleic acids, nucleotides and phospholipids bacteria, the low phosphate value of the College of Veterinary Medicine Non-agricultural soil and the College of Mixed Sciences Agricultural soil 0.15 may be due to the absorption of phosphorus ion by soil particles, therefore, it is difficult to re-dissolve it or to react organic matter with phosphorus, forming a complex phospho_organic that prevents phosphorus deposition or stabilization, as for the reason for the high phosphate in the College of Agricultural Soil Engineering, it may be due to the addition of phosphate fertilizers, as plants respond to growth by adding phosphate fertilizers, but the added phosphorus quickly turns into insoluble compounds, the forms in which phosphorus is formed in the soil determine the effectiveness of phosphate fertilizer in crop growth, this is also related to the origin and composition of the soil, as the increase in phosphorus can be due to the role played by organic residues by dissolving some different compounds of poorly soluble phosphorus, the results recorded significant differences between the College of Veterinary Medicine and the College of Mixed Agricultural Soil and the College of Agricultural Soil Engineering, as well as differences between all study areas and between the values of agricultural and non-agricultural soil for the same region may be due to the different regions and the factors they are exposed to affect the percentage of phosphorus in the soil, such as the addition of organic fertilizers, as well as the association of phosphorus with physical and chemical factors in each region that affect phosphorus values between regions.

5. Calcium CA:

The lowest value of calcium was in the College of Mixed Science Agricultural soil, it amounted to 1.62% this may be due to its consumption by plants Calcium is one of the macronutrients that the plant needs in relatively large quantities and is necessary for the growth of bacteria, therefore, the reason for the lack of growth of bacteria in the College of Mixed Science may be agricultural soil, and the highest calcium value reached 3.54% in the College of Agriculture Non-agricultural soil, it may return to dust storms, of which calcium compounds constitute 40%, which are deposited in the soil, the results showed that there are significant differences between the studied areas, which may be due to agricultural activities or to the original material from which the soil was formed.

6. Magnesium Mg:

The magnesium ion is one of the elements necessary for plant growth and the formation of chlorophyll molecule, as it is found in natural waters and is frequently found in mineral water springs, it is also necessary in water for agricultural use that magnesium is one of the basic ions for the growth of bacteria, as it participates with calcium ions in stabilizing cell walls and cell membranes, as well as binding to some components of the cell wall in bacteria for the purpose of fixation, the lowest value of magnesium was recorded in the College of Agricultural Soil Engineering and the highest value in the College of Non-Agricultural Soil Engineering, and the high percentage of magnesium may be due to the addition of chemical fertilizer that contains magnesium.

7. Sulfates:

Sulfur is found in the soil in mineral form and organic form Sulfur is one of the major elements necessary for plants, Sulfur is an important nutrient for bacteria, as sulfur also plays a role in the energy-gain processes in a number of anaerobic bacteria, the lowest sulfate value was recorded 50 in the College of Agriculture Agricultural soil and the highest value of 1182 in the College of Engineering Non-agricultural soil The rise in sulfate may be due to the addition of a chemical fertilizer containing sulfur, clarification of the results recorded Significant differences between study areas

8. Heavy Metals:

Heavy metals are useful and necessary in trace concentrations for metabolic activities and bacterial growth, as they are known as micronutrients such as iron, cobalt, lead and copper, copper is essential for the growth of bacteria as it helps in the synthesis of metalloproteinase, it also enters into the synthesis of some enzymes and helps in the transfer of electrons for redox processes, but there are some heavy metals that do not have biological effectiveness, but are toxic and deadly to microorganisms, even if they are in small concentrations such as cadmium, the lowest value of iron, lead, nickel, copper and cadmium was recorded in the College of Agricultural Soil Engineering, the College of Veterinary Medicine Non-Agricultural Soil, the College of Agricultural Soil Engineering, the College of Veterinary Medicine, Non-Agricultural Soils and the College of Veterinary Medicine Agricultural Soils respectively, and the highest value in the College of Non-Agricultural Soil Engineering, the College of Agricultural Soil, the College of Non-Agricultural Soil Engineering, the College of Non-Agricultural Soil Engineering, and the College of Agriculture Non-Agricultural Soil, the results showed significant differences between one region and another.

9. Bacteria in the Soil:

Bacteria in the soil are an effective element among terrestrial ecosystems through their importance to the plant, which is the first product, as bacteria have many important vital functions for the soil, including nitrogen fixation, bacteria in addition to their importance in fixing nitrogen and phosphorus increase soil fertility and provide nutrients, bacteria have been used as a substitute for fertilizers to avoid contamination caused by agricultural chemicals, the number of bacteria diagnosed in the current study was 35 isolates, the genus Sphingomonas paucimobilis was predominant, reaching 12 species and with a percentage of 34.29% of the total found in all regions, except for the College of Mixed Sciences Agricultural Soil, the College of Agricultural Soil Engineering, and the College of Veterinary Medicine Non-Agricultural Soil, this may be due to the ability of this species to withstand inappropriate environmental conditions and adapt to them, then comes the genus Staphylococcus, as it reached 4 species and by 11.43%, then the genus pasteurella, it reached 3 species and 8.57%, then the genus E. Coli, Serratia Rubidaca, Aeromonas veronil, Pantora spp, as it reached 2 species and by 5.71%, then the genus Psuedomonas fluorescence and by 3.5% this genus is one of the beneficial bacteria for the soil and provides biological control properties, for example, protects the roots of some plant species against parasitic fungi, the results indicated that there were significant differences in the preparation of bacteria in the study areas and between the same areas, the lowest growth rate was in the College of Mixed Science Agricultural Soil and the College of Veterinary Medicine Non-Agricultural Soil, it may be due to the low percentage of essential nutrients in the soil and an increase in the concentration of lead, which is lethal to bacteria if it is in high concentrations, the largest numbers of bacteria were recorded in the College of Veterinary Medicine agricultural soil and may be due to the availability of nutrients suitable for the growth of bacteria and that the pH value is suitable for the growth of most types of bacteria.

CONCLUSIONS:

1. The biodiversity of bacteria in soils is affected by the physical and chemical properties of these soils.
2. The plant grown in the soil and soil tissue plays a role in the spread of bacteria

3. The predominance of species belonging to the genus Sphingomonas paucimobilis on the rest of the species in all study areas.

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