Study of the effect of bacterial bioactive compounds 1-octadecene and isopropyl myriatate on biocontrol and growth promotion of tomato plant growth

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Abstract

The study dealt with the use of two effective compounds: 1-octadecene and Isopropyl myristate, which were extracted from bacteria and filamentous bacteria technology, HPLC. We saw their effect on the tomato plant with two therapeutic and preventive lines. at two concentrations of 5% and 10% when the tomato plant was infected with the pathogens Pseudomonas sp. Erwinia sp. and the fungus F. solani. the results showed that the quality of their secondary metabolic components was determined using high-performance cosmography linked to liquid chromatography-mass spectrometry (LC-MS). The analysis revealed many active components in bacteria and filamentous bacteria. The results of the pot experiment also showed 16 treatments. The percentage of NPK and chlorophyll in the leaves of the tomato plant were measured. In the preventive treatments, the effective compounds were added to the plant when planting, or in the therapeutic treatments, the plant was infected two weeks after the infection, and the compounds were added by spraying, as the preventive treatments gave better results than the curative treatments, as they gave the highest chlorophyll treatment in the preventive treatments: 1-Octadecene + Isopropyl myristate + Pseudomonas. sp reached 52.0 and 54.4% for the two concentrations, 5 and 10%, respectively, and the percentage of nitrogen 1-Octadecene + Pseudomonas sp reached 42.2 and 47.1%, respectively. As for phosphorus and potassium, it gave the highest percentage of phosphorus, 1-octadecene + and Erwinia sp.0.26 and 0.56% for the two concentrations, respectively. As for the peroxide enzyme, it gave the highest protective coefficients of 0.16 and 0.45% for the two concentrations of 5 and 10%.

Introduction

The use of biological control agents is a promising and environmentally friendly means of improving agricultural production levels, reducing damage, and reducing the use of chemical pesticides and their residues in the environment [1]. Several biological agents were used to control the plant pathogens at the experimental or applied levels, Some of them succeeded as biological succeeded as biological control agents, such as the Trichoderma fungus and Pseudomonas bacteria. The fungus Chaetomium globosum was also among the biological control elements that have received a lot of attention, especially in controlling vegetative diseases, disease.The basic idea behind usingthis fungus was its ability to grow rapidly on dead leaves, deprives mushrooms of their food base.

Themodern agriculture is constantly developing After the widespread use of bio which all biofertilizers owed a significant increase in production in the twentieth and new agricultural techniques began to emerg .[2] The next challenge to be faced is to feed about 9 billion people by 2050 .[34] In this context, one of the main concerns is to expand

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food production capabilities, including those derived from plants, while preserving the environment . [5]Nowadays, countries are striving to expand their food production to meet their needs [6] An increase in the production of a particular crop is often associated with improving farming techniques, especially the use of more productive varieties with resistance to major diseases .[7[

The search for natural products with vital activity is constantly increasing, with the main emphasis on compounds resulting from the metabolism of plants and microorganisms.Microbia.receptors became the target of many innovative biotechnology research studies, which were conducted to develop new bioactive products capable of exerting antimicrobial activity against important plant pathogens, granting control over various plant diseases, inducing their resistance, and reducing the damage caused by such infections. Natural antimicrobials may be the key to controlling plant pathogens in a more sustainable and environmentally riendly way once different antimicrobials also induce systematic resistance. They offer diverse structures and unique chemical properties, which directly affect the mechanism of their action. Among the most studied microorganisms relevant to this field, the group of filamentous Actinobacteria stands out as the largest group of receptor producers, followed by Pseudomonas and Bacillus genera . [8,9[

The research aims to indicate that bacteria contain large quantities of effective biologically active compounds used to inhibit plant pathogens, which have an effective role in increasing the proportions of elements .

Material and Me thods

Analysis by High performance liquid chromatography (HPLC(

A solution of bacteria and filamentous bacteria was prepared. 10 mg of the crude extract of secondary metabolites was dissolved in 10 ml of 99% methanol alcohol. The mobile phase was used ,

consisting of distilled water in a ratio of 25:75 v/v. The column type was C18, and a wavelength of -205 was used. 215 nm and a flow rate of 1 ml/min. The compounds were identified in each sample by comparing their detention times with those of standard solutions. Separation was performed in the HPLC device affiliated with the College of Pharmacy, Clinical Laboratory Sciences Branch, University of Basra [10] Measurement of the purity of active compounds by liquid chromatographic analysis using a coupled mass spectrometer

Liquid chromatography–mass spectrometry (LC–MS)

This technique was used to diagnose active compounds extracted from bacteria and filamentous bacteria using (LC-MS)technology at the College of Medicine, University of Basra.

The effect of some isolates of bacteria and filamentous bacteria in reducing the infection caused by the fungi F. solani, the bacteria Erwinia, and Psedomonas on tomato plant growth.Agricultural

The soil was sterilized with with a formalin solution (1 part formalin 50 parts water). The solution was used at a rate of 3 liters/m3 [11]. The soil was placed in plastic bags and closed well for 3 days, then exposed to the air under sunlight for 3 days in order for the formalin to evaporate from it. I sterilized a quantity of peat moss in the same way as sterilizing the soil. Peat moss was mixed with the soil 1:2 (soil: peat moss). Then two lines were carried out, a therapeutic and a preventive line, according to specific

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treatments. The soil was moistened after that and left for two days. Then the tomato seeds were planted in plastic pots, 17 cm high, 20 cm in diameter, and 3kg capacity, at a rate of 1 seed per pot. The experiment lasted for 5 weeks

The compared treatments included three replicates:

.1 Soil only
.2 Soil + F. solani
.3 Soil + Erwinia bacteria
.4 Soil + Psedomonas bacteria
.5 Soil + isopropyl myristate
.6 Soil + material 1- octodecan
.7 Soil + isopropyl myristate + 1- octodecan

The treatments of the therapeutic and preventive lines were also included in three replicates

.1 Isopropyl myristate + F. Solan
.2 Isopropyl myristate + Erwinia bacteria
.3 Isopropyl myristate + Psedomonas bacteria
.4 Article 1- octodecan + F. Solan
.5 Substance 1- octodecan + Erwinia bacteria
.6 Substance 1- octodecan + Psedomonas bacteria
.7 Isopropyl myristate + 1- octodecan + F. Solan
.8 Isopropyl myristate + 1- octodecan + Erwinia bacteria
.9 Isopropyl myristate + 1- octodecan + Psedomonas bacteria

All my expenses have been calculated:

The amount of chlorophyll and NPK in tomato leaves was calculated

Determination of total nitrogen (N)

Nitrogen in the digestion solution was determined using a Micro-Kjeldahl distillation device [12[

Determination of phosphorus (P)

Total phosphorus was determined using a Spectorphoto meter using the blue color method after adjusting the acidity of the mixture at a wavelength of 700nm.

Determination of potassium (K)

Total potassium was measured using a flame photo meter as described by [13[

Limited leaf content of total chlorophyll:

The total colophil of plants was calculated in the leaves of leafy plants (the fourth leaf), where a weight of 0.5 g was taken from each loss immediately for three replicates and crushed using a ceramic mortar with the addition of 10 ml of diluted acetone [14] 80% to the colophil, then the dye was removed using coated filter paper. They were set correctly in tubes placed in the university student center (fuge) for 10 minutes, and after 6000 training cycles, I used a UV-visible spectrophotometer type JENWAY 6305 to follow the optical absorption of the dyes at two wavelengths of 663 and 645 nm, then I calculated the total amount of colophil dye (Amalgam leaf dye/100g fabric shade) by applying the following:

Total Chlorophyll = [20.2 D (645) + 8.02 D (663) (V/W× 1000) × 100[

Note that: D is optical absorption

: D (663) Optical absorption reading at a wavelength of 663 nm.

D (645): Optical absorption reading at a wavelength of 645 nm.

V: Final volume of extract (10 ml.(

W: Weight of paper fabric (0.5g.(

Estimation of the enzymatic activity of the POD enzyme

The vegetative part of the fresh plant samples (leaf) was crushed with 10 ml of KHPO4 in a ceramic mortar under refrigerated conditions. The mixture was then filtered using filter paper, placed in the in the refrigerator at a temperature of 2 °C, andand prepared for the

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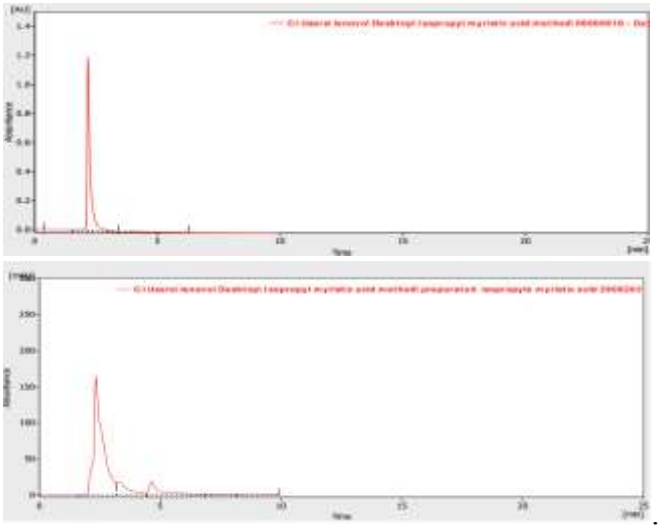
purpose of estimating enzymatic activity later according to the method described before. [15] Then the absorbance of the enzyme was measured in a spectrophotometer at a wavelength of 436 nm, and the change in absorbance was monitored every 30 seconds for five minutes. The activity of the POD enzyme was then calculated through the following equation:

Results and Discussion

High Performance Liquid Chromatography (HPLC(

The two compounds, Octadecene Isopropyl myristate, 1 - produced from the secondary metabolic compounds of the bacteria Bacillus sp. the filamentous bacteria Actenomyces sp, were extracted and compared with the standard solution using HPLC technology. Figure (C, D) shows the diagnostic results, as the chromotramates of the compounds, isopropyl myristate and-1 Octadecene appeared. For bacteria and filamentous bacteria, when they are injected with an HPLC device, the detention time (minute), concentration (area), and % concentration for secondary metabolite compounds are shown. The presence of 1-octadecene and isopropyl myristate in the bacteria and filamentous bacteria was confirmed by matching the values of the two compounds with the standard medium at the same detention time, as The retention time of the standard compound Isopropyl myristate was 2.232 minutes, and the absorbance appeared at the highest peak, reaching 297.043 mAU. This result is considered an indicator of the ease of separating the compound, as there is no interference. As for the compound, 1-Octadecene, the retention time was (2.340) minutes. The absorbance also showed a clear similarity between the peaks if it reached (163.105) mAU, respectively. This confirms that the compound produced from the standard medium is For the two compounds [16] indicated that the compound Isopropyl myristate was identified with a 7100 ultraviolet detector and a C18 column. The mobile phase was a mixture of methanol and distilled water with (0.5% triethylamine) at a ratio of 70:30 (weight/volume) and the pH was adjusted to 3.5 Using phosphoric acid, 20 microliters of samples were injected at a flow rate of 1.0 ml/min, a mod length of 247 nm, and a temperature of 40 C



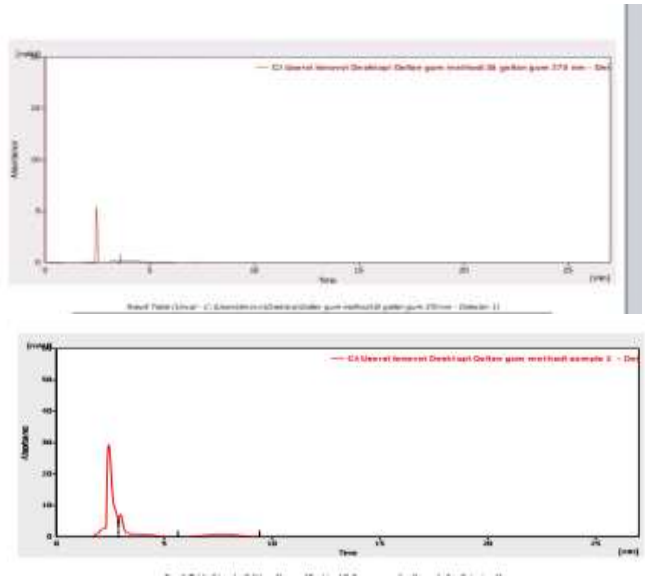


Figure (A) shows the compound chromotram Isopropyl myristate for the standard substance (standard solution(

Figure (B) shows the compound chromotram, 1-Octadecene, for the standard substance (standard solution.(

Figure (C) shows the chromotram compound, Isopropyl myristate, extracted from metabolite compounds

Figure (D) shows the compound chromotram, 1-Octadecene, extracted from metabolite compounds.

is of active compounds Diagnosis of active compounds by (LC-MS) analysis

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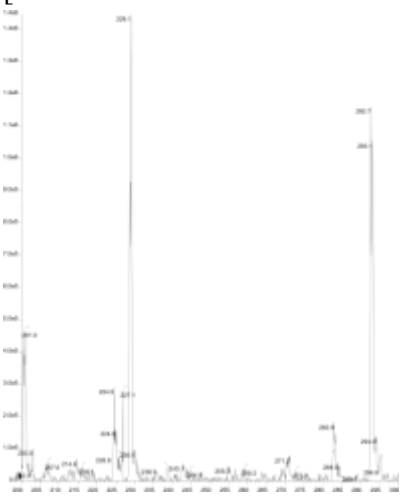
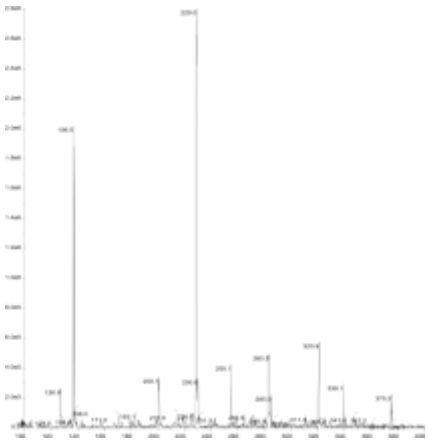


Isopropyl myristate

After analyzing the standard medium and purifying the active compounds by HPLC analysis, a highly efficient technique was used to accurately detect some of the active compounds extracted with the methane solvent from bacteria. The results of the analysis were shown for qualitative detection in diagnosing the active compounds to confirm the purified material by LC-MS analysis, and the purity of the active compounds was confirmed. For the two substances, Isopropyl myristate has a peak of 229.1 and Octadecene1 has a peak of 2.806. These results were consistent with what was mentioned [17



-1Octadecene

Estimation of chlorophyll and the elements phosphorus, potassium, and nitrogen in tomato leaves in therapeutic treatments

Table 1 shows that that there is a significant effect of the treatments containing active substances at a concentration of 1% compared to the pathogenic treatments on the chlorophyll content of the leaves, where the soil treatment +1-Octadecene + Isopropyl myristate gave the highest rate of 53.7 mg of concentration. While the treatments not treated with active materials gave the lowest soil F+ soil F+ rate, Solani reached 39.3 mg, and soil and Erwinia sp. Reached 42.7 mg. These results are consistent with those of Abdel Rahimand [18]. It was observed that when adding the active ingredients to the pathogens, there was a significant difference in the chlorophyll content of the leaves, as the treatment with 1-Octadecene + Isopropyl myristate + Pseudomonas sp reached 52.0 mg and with 1-Octadecene+ Isopropyl myristate + Erwinia sp. It amounted to 46.6 mg. At the concentration of 2% the table shows that there is a significant effect of the treatments that contain the active substances at the concentration of 2%, compared to the pathogenic treatments on the chlorophyll content of the leaves, as it gave the highest rate. The treatments that contain two active substances resulted in a high percentage of chlorophyll in the leaves as they reached the soil 1-Octadecene + Isopropyl myristate + Erwinia sp reached 54.1 mg and 1-Octadecene + Isopropyl myristate + Pseudomonas sp reached 54.4 mg, while the treatments not treated with the active materials gave the lowest rate: soil + Erwinia sp reached 2.16 mg and soil + Pseudomonas sp reached 2.08 mg. . It was observed that when adding the active ingredients to the pathogens, there was a significant difference in the chlorophyll content of the leaves, as the Isopropyl myristate + F. solani treatment amounted to 50.1 mg, and 1-Octadecene + Pseudomonas sp reached 47.1 mg.

The reason for the increase in the chlorophyll content of the leaves may be due to the addition of active substances extracted from bacteria and added to the soil, which increases the rates of nitrogen released in the soil, and this in turn increases the accumulation of nitrogen in the plant, as well as improving the physical and chemical properties of the soil, thus increasing the chlorophyll content of the leaves [19], where nitrogen is involved in the formation of chlorine phyllo, as well as the formation of amino and fatty acids that are involved in the formation of chloroplasts [20] .Peter and [21] confirmed that the percentage of nitrogen in leaves can be known through their chlorophyll content, as most of the

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nitrogen in plants is concentrated in the leaves, and this also confirms the direct connection of nitrogen to this characteristic.

The increase in chlorophyll content is due to the radical stimulation of additives, absorption, and assimilation, and this increases efficiency in using photosynthesis energy for growth[22. [

The results of the leaf content table showed a good percentage of nitrogen ,phosphorus, and potassium, as the treatment excelled in increasing the nitrogen concentration for the first 1-Octadecene + Pseudomonas sp, which reached 2.46%, and 1-Octadecene + Isopropyl myristate + F. solani, which reached 2.38% and 1 -Octadecene + Isopropyl myristate + Pseudomonas sp reached 2.33, while in the second concentration, the Soil + Isopropyl myristate treatment excelled, giving 2.44%, and 1-Octadecene + Isopropyl myristate + Pseudomonas sp gave 2.62%, and the lowest percentage of nitrogen was in the 1% treatment. -Octadecene + Erwinia Sp. which amounted to 1.52%, and 1-Octadecene + F. solani, which amounted to 1.62%. As for the concentration of 2%, the lowest percentage of nitrogen was in the isopropyl myristate + F. solani treatment, which amounted to 1.82%,and 1-Octadecene + Erwinia sp, which amounted to 2%. The role of nitrogen in increasing vegetative growth results in an increase in the products of photosynthesis and vital processes that lead to an increase in the activity of the roots, making them more efficient in absorbing it from the soil, and then increasing its levels in the plant tissues. The addition enhanced the concentrations of this element in the plant tissues, resulting in an increase in the nitrogen content in the leaves, and this is consistent with This result is in line with what was mentioned by[23,24,25. [

Nitrogen plays an important role in plants by increasing vegetative growth. It also performs many important physiological functions for plants, as it is involved in the formation of protein, nucleic acids, chlorophyll, enzymes, vitamins, and plant hormones. The presence of high or low levels of nitrogen is harmful to crop health and production .[26,27[

A table indicates that there are significant differences between the treatments in the phosphorus content of the leaves, where the treatment Soil + Isopropyl myristate and 1-Octadecene + Isopropyl myristate + Pseudomonas sp reached 0.32 and 0.60% for the two concentrations to increase the phosphorus content of the leaves compared to the lowest phosphorus percentage in treatment 1- Octadecene + F. solani and its soil + F. solani, which amounted 0.02 and 0.30% for the two concentrations, respectively. The reason for the proportion of phosphorus in plants may be due to the increase in the number of microorganisms in the soil and their increased activity, which increases the mineralization and readiness of the elements in the soil and then in the plant. This is in addition to improving the composition of the soil, maintaining the moisture content in it, and increasing ventilation in it, which provides a suitable environment for the growth of roots and has effect on the absorption of elements. [28.[

Phosphorus is also considered of great importance in energy compounds and the construction of nucleic acids, enzymatic conjugates, and phospholipids [29]. Phosphorus may stimulate cell division, which affects the increase in the number of branches, in addition to the role of potassium in increasing vegetative growth as a carrier of manufactured nutrients from the source (leaves) to the growing area [30, 31]. The

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effect of phosphorus is fundamental. Its role is to stimulate the root system and increase its strength. The plant's ability to absorb water and nutrients that are appropriate to the plant's need to carry out its vital activities, including photosynthesis, which affects the amount of manufactured carbohydrates [32,33[

As can be seen from the results of the table, the superiority of the treatments 1-Octadecene + Isopropyl myristate + Pseudomonas Sp. and 1-Octadecene + Isopropyl myristate + F. solani reached 1.88 and 1.90% in increasing the potassium content of leaves for the two concentrations, respectively, while the lowest percentage was in Treatment 1-Octadecene + F. solani, reaching 1.22 and 1.39%, respectively. The reason for increasing the percentage of potassium may be due to the addition of active substances that work to increase potassium. Potassium also plays an important role in regulating the osmotic potential of plant cells and in the process of opening and closing stomata. It is also necessary for the transport of metabolic products as well as in protein formation[34 .[

As for the role of potassium in increasing this trait, it may be due to its involvement in the process of the starch formation and the increase in the activity of the Starch synthetase enzyme. It has been observed that this enzyme is ineffective, and the amount of plant ready energy is reduced when there is a potassium deficiency. These results are consistent with what was found by [35, 36.[

[37,38] have indicated the effect of N, P, and K on increasing leaf area. The reason for the increase in leaf area may be attributed to the role of nitrogen in increasing the leaves' chlorophyll content and increasing carbon metabolism, with the help of potassium in activating the enzymes of this process and transporting their products, which are used in growth (the leaf). The energy to accomplish this process is transferred with the help of phosphorus[39,40[

Table 1 .Estimation of chlorophyll and the elements phosphorus, potassium, and nitrogen in tomato leaves in preventive treatments

K% %10	P% %10	N% %10	Determination of chlorophyll %10	K% %5	P% %5	N% %5	Estimation of chlorophyll %5	The 3 1 transactions
1.26	0.01	1.71	38.4	1.26	0.01	1.71	38.4	Soil only
1.59	0.49	2.44	39.2	1.47	0.32	2.24	51	+ SoilIsopropyl myristate
1.57	0.49	2.31	52.5	1.46	0.27	2.24	51.4	+ Soil1-Octadecene
1.66	0.56	2.24	52.0	1.64	0.22	2.23	53.7	+ Soil1-Octadecene +Isopropyl myristate
1.46	0.48	2.30	42.1	1.52	0.19	1.88	42.7	+ SoilErwinia sp
1.45	0.30	2.16	41.2	1.38	0.17	1.87	39.3	+ SoilF. solani
1.49	0.46	2.08	52.1	1.56	0.16	1.83	44.8	+ SoilPseudomonas sp
1.48	0.40	2.19	41.6	1.46	0.19	1.92	40.1	Isopropyl myristate +

								Erwinia sp
1.75	0.52	2	50.1	1.85	0.18	1.94	43.3	Isopropyl myristate + F. solani
1.88	0.52	2.08	46.7	1.68	0.18	1.98	44.4	Isopropyl myristate + Pseudomonas sp
1.65	0.56	1.82	46.3	1.65	0.26	1.52	46.6	1-Octadecene + Erwinia sp
1.39	0.49	2.12	45.6	1.22	0.02	1.62	45	1-Octadecene + F. solani
1.47	0.54	2.19	47.1	1.35	0.2	2.46	47.6	1-Octadecene + Pseudomonas sp
1.90	0.55	2.26	45.3	1.67	0.22	2.38	44.7	1-Octadecene + Isopropyl myristate + F. solani
1.77	0.54	2.24	54.1	1.56	0.24	2.25	46.6	1-Octadecene + Isopropyl myristate + Erwinia sp
1.67	0.60	2.62	54.4	1.88	0.23	2.33	52.0	1-Octadecene + Isopropyl myristate + Pseudomonas sp
0.025	0.032	0.046	6.32	0.033	0.039	0.034	4.85	$LSD_{0.05}$

Estimation of chlorophyll, nitrogen, phosphorus, and total potassium and their ratio in therapeutic treatments

The results of this experiment showed that all treatments were superior,with significant differences, to the rest of the chlorophyll treatments. The soil treatments +1-Octadecene and isopropyl myristate reached 35.53% and 34.10%, respectively, for the two concentrations alone. The best

treatments were followed by the soil treatments +1-Octadecene and isopropyl myristate, which reached 32.77 and 33.18%,

respectively for the two concentrations, while the lowest chlorophyll content was in the +F soil treatment. Solani reached 20.65 and 23.95% for the two concentrations, respectively.

The results of the table showed that the rate of the major elements, namely nitrogen, phosphorus, and potassium, in tomato plant leaves in untreated soil is 1.68, 0.48, and 2.21% for the two concentrations, respectively, NPK. The results also showed that the breeding treatment with the active substance led to an increase in the rate of these elements in the plant leaves, as the highest nitrogen rate was recorded in the treatment of 1-Octadecene + Isopropyl myristate + Pseudomonas sp. and 1-Octadecene + isopropyl myristate + F. solani, which reached 2.41 and 2.42%. For the two concentrations, there was a significant difference in the comparisontreatment. The highest rate of phosphorus was in the isolate treatment 1-Octadecene + Isopropyl myristate + Pseudomonas sp and its soil + 1-Octadecene +

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Isopropyl myristate, which is 0.65 and 0.64% for the two concentrations, and the highest rate of potassium was in the treatment 1-Octadecene + Isopropyl myristate + Pseudomonas sp. Sp, which is 2.68 and 2.78% for the two concentrations, as nitrogen performs important functions in plants through the formation of proteins, nucleic acids, chlorophyll, enzymes, vitamins, plant hormones, and growth regulators. It is also involved in the formation of cell membranes and energy compounds.

As for phosphorus, it is the basic component of many proteins, enzymatic chaperones and nucleic acids. It is also involved in the construction of energy-rich compounds such as ATP. It has a role in the process of cell and in the growth and formation of roots and affects the process of maturation and the production of seeds and flowers, while potassium is necessary for the formation of proteins and carbohydrates and the conversion of carbohydrates. It is converted into fat and plays a role in the movement of sugars from the leaves to the rest of the plant. It encourages the transfer of carbohydrates from manufacturing sites to storage sites. It is responsible for controlling the movement of guard cells in the respiratory stomata, as well as the water content in the plant. It has a role in increasing the plant's resistance to diseases and increasing resistance to temperatures. High altitudes and frosts, and it has a role in the formation of chlorophyll (Jones [41.42,43[

The role of the bacteria B. subtilis in increasing major nutrients may be due to the fact that it colonizes the roots of the plants treated with it, giving those roots strength and making them less susceptible to infection by pathogenic fungi and tolerating stress and various factors to which the plant is exposed, which improves its ability to absorb nutrients as well as stimulating its resistance. systemic in plants [44], and agrees with [45], who mentioned that the use of bacteria. B. subtilis led to an increase in N, P, and K elements in tomato plants treated with this bacteria. The role of substances extracted from bacteria is attributed to increasing the concentration of major nutrients, as it works to activate and stimulate the production of natural resistance mechanisms within the plant, such as increasing the activity of enzymes such as glucose, which is called induced resistance, which makes the plants grow well, which increases their ability to benefit from the existing nutrients. With its ability to achieve high to achieve high resistance to pathogens [46], it also has a major role in regulating most life activities by stimulating plant roots to increase the production of phenolic compounds that play an important role in regulating the flowering and photosynthesis processes, that is, they are essential for growth. to plant [47[

The decrease in the concentration of major nutrients in treatments containing pathogens is due to injury to the root, as well as the base of the stem close to the soil surface, with ulceration and rot as a result of infection by pathogens in the tissues. This injury reduces the plant's efficiency in absorbing water and nutrients, leading to the plant's weakness compared to a healthy plant[48 .[

These results are consistent with many studies [49,50] in which they indicated that isolates of filamentous bacteria, including the genus Streptomyces, work to enhance plant growth by providing it with nutrients, including nitrogen. This element is essential for the plant and is provided to the plant in the form of ammonia through the fixation of atmospheric nitrogen [51], the dissolution of phosphate, and the production of enzymes that convert

complex nutrients into simple mineral forms absorbable by plant roots[52], explained [53]that the bacteria used in biological control or the bacteria that are isolated from around the roots positively affect the growth of the plants treated by secreting some metabolites that affect the plants directly without affecting other microorganisms that are naturally present around the roots through Increasing the concentration of some basic elements that the plant needs, such as nitrogen, phosphorus, and sulfur, or secreting some growth enzymes that the plant benefits from

Table 2 Estimation of chlorophyll, nitrogen, phosphorus, and total potassium and their ratio in therapeutic treatments.

K% %10	P% %10	N% %10	Estimation of chlorophyll %10	K% %5	P% %5	N% %5	Estimation of chlorophyll %5	Transactions
2.21	0.48	1.68	38.4	2.21	0.48	1.68	38.4	Soil only
2.41	0.51	2.25	33.18	2.18	0.52	2.06	32.28	+ SoilIsopropyl myristate
2.29	0.52	2.25	33.17	2.07	0.49	2.15	32.77	+ Soil1-Octadecene
2.46	0.64	2.31	34.10	2.22	0.67	2.18	35.53	+ Soil1-Octadecene + Isopropyl myristate
1.91	0.51	1.56	25.28	1.69	0.45	1.88	25.18	+ SoilErwinia sp
2.25	0.44	1.44	23.95	2.01	0.4	1.13	20.65	+ SoilF. solani
2.20	0.51	1.66	27.03	2.05	0.47	1.45	24.63	+ SoilPseudomonas sp
2.42	0.55	1.78	30.25	2.14	0.33	1.63	26.07	Isopropyl myristate + Erwinia sp
2.08	0.41	1.88	25.28	2.10	0.35	1.71	25.18	Isopropyl myristate + F. solani
2.35	0.52	2.18	29.90	2.27	0.37	1.75	28.02	Isopropyl myristate + Pseudomonas sp
2.62	0.55	1.95	30.90	2.55	0.58	1.72	28.50	1-Octadecene + Erwinia sp
2.56	0.53	1.84	30.37	2.33	0.48	1.66	29.28	1-Octadecene + F. solani
2.65	0.55	1.69	32.32	2.36	0.55	1.62	28.93	1-Octadecene + Pseudomonas sp
2.47	0.52	2.42	31.52	2.62	0.51	2.09	31.37	1-Octadecene + Isopropyl myristate + F. solani
2.64	0.55	2.31	31.78	2.54	0.59	2.10	31.85	1-Octadecene + Isopropyl myristate +

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								Erwinia sp
2.87	0.62	2.41	33.12	2.68	0.65	2.41	30.17	1-Octadecene + Isopropyl myristate + Pseudomonas sp
0.38	0.09	0.3	4.35	0.43	0.14	0.51	4.53	$LSD_{0.05}$

The effect of the active ingredient 1-Octadecene and Isopropyl myristate on the peroxide enzyme in preventive and therapeutic treatments.

The results showed a controversial increase in the activity of the peroxidase enzyme in tomato plants in the protective treatments compared to the curative treatments, where the protective treatment that was superior to all the treatments in soil +1-Octadecene + Isopropyl myristate was 0.25 and 0.98, respectively, for the two concentrations, followed by the treatment of soil + Isopropyl myristate, 0.19 and 0.95, respectively. For the two concentrations, while the treatment treatments, where the highest soil treatment +1-Octadecene + Isopropyl myristate reached 0.06 and 0.14, respectively, for the two concentrations, followed by the soil + Isopropyl myristate treatment, reached 0.5 and 0.13. Based on the results of this study, it was shown that infection symptoms decreased with an increase in the peroxidase enzyme, which increased ability of the active compounds to stimulate systemic resistance mechanisms and reduce the effect of the disease. An increase in the active compounds led to an increase in the peroxidase enzyme to the physiological [

functions of these compounds in increasing the plant's ability to withstand environmental stress through increased enzymaticenzymatic activity within the plant and increasing the process of photosynthesis as well as A cycle in the stability of the cell membrane and the chlorophyll pigment, so its effectiveness increases as a response to curb the harmful effect of stress and as one of the biochemical mechanisms to combat environmental stress [54.[

[55,56] stated that the induction the peroxidase enzyme in plant tissues upon exposure to pathogens has a crucialrole in determining the level of host resistance. It is a major enzyme in lignin biosynthesis, suberin deposition, and cell wall biosynthesis. That is, increasing structural defenses. It converts the extensins secreted in the apoplast from soluble monomeric motors into an insoluble network, depending on H2O2, which in turn leads to increased plant defense[45]. The enzyme Phenylalanine ammonia lyase (PAL) works in the biosynthesis of plant secondary metabolic compounds, such as the production of many phenolic compounds that lead to increased lignin deposition and thickness of cell walls [57

Table 3 The effect of the active ingredient 1-Octadecene and Isopropyl myristate on the peroxide enzyme in preventive and therapeutic treatments.

Peroxidase enzyme 10% therapeutic	Peroxidase enzyme 5% therapeutic	Peroxidase enzyme 10% preventive	Peroxidase enzyme 5% preventive	Transactions
0.05	0.05	0.05	0.05	Soil only
0.13	0.05	0.95	0.19	+ Soil Isopropyl myristate
0.11	0.04	0.88	0.18	+ Soil1-Octadecene
0.14	0.06	0.98	0.25	+ Soil1-Octadecene + Isopropyl myristate
0.04	0.01	0.16	0.06	+ Soil Erwinia sp
0.05	0.02	0.15	0.05	+ SoilF. solani
0.04	0.02	0.18	0.08	+ Soil Pseudomonas sp
0.07	0.04	0.24	0.09	Isopropyl myristate + Erwinia sp
0.06	0.05	0.21	0.07	Isopropyl myristate + F. solani
0.08	0.06	0.25	0.09	Isopropyl myristate + Pseudomonas sp
0.07	0.02	0.27	0.09	1-Octadecene + Erwinia sp
0.06	0.01	0.26	0.06	1-Octadecene + F. solani
0.07	0.03	0.37	0.08	1-Octadecene + Pseudomonas sp

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0.09	0.03	0.58	0.10	1-Octadecene + Isopropyl myristate + F. solani
0.10	0.03	0.45	0.16	1-Octadecene + Isopropyl myristate + Erwinia sp
0.09	0.02	0.38	0.15	1-Octadecene + Isopropyl myristate + Pseudomonas sp
0.08	0.01	0.15	0.06	$LSD_{0.05}$

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