A comparison of the antioxidant and antimicrobial effects of phenolic extracts from plants growing in Oued Souf, "Haloxylon articulatum Bioss and Arnebia decumbens Vent Coss and Kral"

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Abstract:

This research will look at the plants *Haloxylon articulatum Bioss and Arnebia decumbens Vent Coss and Kral*, which grow in OuedSouf, Algeria. Which treatments are often employed in medical science. This research focuses on the antioxidant impact and biological activity of plants, taking into consideration the extraction of the active ingredient's phenol. Using a scanning equipment and high-performance liquid chromatography, the active components were discovered (HPLC). The present research used a qualitative and quantitative method to get a deeper understanding of the body of information around the extraction process. Both the antibacterial activity of the phenolic extracts and their oxidation levels were investigated separately. The findings demonstrated that there was a significant impact on the production of free radicals as well as the multiplication of a number of different bacterial strains. In addition, the antibacterial agents known as "polymyxin B" and "ampicillin" were shown to have less of an effect on the bacteria *Bacillus cereus ATCC 14579* and *E. coli ATCC 25922* than the phenolic extracts did.

Keywords: Haloxylon articulatum Bioss, Arnebia decumbens Vent Coss and Kral, antioxidant, antibacterial activity.
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1. Introduction

Near the southeast of Algeria, mostly in the city of OuedSouf, there are two big facilities that extract phenolic compounds. *Arnebia Decumbens Ven tCoss and Kral Haloxylon articulatum Bioss* are the two species that produce this moss [1-4].In the region of Southeast Algeria known as *Arnebia Decumbens Vent Coss and Kral*, a microscopic red pigment may be discovered in the crust of the roots of herbaceous plants. This pigment is often referred to as "homaire." It should not be larger than 25 centimeters.It has stiff bristles that resemble thorns when they reach the plant and begin to dry *Arnebia Decumbens VentCoss and Kral* large leaves with no apparent neck [3].The blooms are bright and crowded towards the apex. *Haloxylon articulatum Bioss*, often known as "Bagel." The Bagel is a tiny, long-lived shrub with numerous branches. It does not have a discernible primary leg but instead grows in the shape of a tangle of branches and stems that work together to capture vast amounts of sand. The leaves are too tiny, and there are pink membranes on them.[5, 6]

Both of the plants on this list are used often in Africa as a kind of natural treatment for a variety of disorders. It is estimated that more than 80 percent of people prefer to make use of traditional medical practices, as shown by the data. The vast majority of them are put to use in the cultivation of plants. The primary advantage of using herbal treatment is that it helps avoid the unfavorable secondary effects of certain synthetic chemical drugs. These unfavorable secondary effects are more often referred to as undesirable side effects [7-9]. In addition, research has indicated a negative link between the intake of foods high in antioxidants and the development of sickness in humans [8,9]. Butylatedhydroxytoluene (BHT) and butylatedhydroxyanisole (BHA) are two synthetic antioxidants that are often used in the food business. It is believed that these antioxidants have a significant role in the development of liver damage, cancer, and toxicity[10-12]. As a consequence of this, it is of the utmost importance to center one's attention on other naturally occurring antioxidant extracts obtained from plants in order to avoid some dangerous circumstances. Plant leaves contain considerable amounts of polyphenols and flavonoids as their primary chemical components. Secondary metabolites are abundant in higher plants and include things like polyphenols and flavonoids [13-15]. Flavonoids are a kind of phenolic chemical, which refers to molecules that include both a benzene ring and a hydroxyl group in their structure. Antioxidants that are found in plants are called flavonoids, sometimes called bioflavonoids (from the Latin word flavus meaning yellow, their colour in nature). Flavonoids They have a 15-carbon skeleton that is composed of two phenyl circles (A and B) and a heterocyclic circle. Chemically, they are known as phenanthrenes (C). The acronym for this carbon structure is C_6-C_3-C_6, and it looks like this: [16]

Recent research has shown that the flavonoids that may be found in vegetables and plants used for medical purposes include antibacterial characteristics. These antimicrobial activities function, among other ways, as anti-allergic, anti-microbial, anti-inflammatory, vasoprotective, and anti-tumor agents [17]. Plants native to the Sahara have high concentrations of a variety of phytochemicals, including phenolic acids, sterols, procyanidins, flavonoids, carotenoids, and anthocyanidins (OuedSouf).*Haloxylon articulatum Bioss* and *Arnebia Decumbens Vent Coss and Kral* have also been shown to be useful from a biological and pharmacological standpoint. Because they have antiviral, antibacterial, anti-inflammatory, and anticancer properties, they help to strengthen the immune system. They also have anti-oxidant properties [16].

To the best of our knowledge, there is no scientific information or empirical proof on the study of the plant, the capacity of anti-

oxidation of bacterial activity on *Haloxylon articulatum Bioss* and *Arnebia Decumbens Vent Coss and Kral* plants. This is the case despite the fact that all of the research was carried out during scheduled appointments. This study aimed to investigate the chemical composition, as well as the antibacterial and antioxidant properties, of natural products isolated from plants that are native to OuedSouf. Specifically, the plants that were studied were *Haloxylon articulatum Bioss*, *Arnebia Decumbens Ven tCoss and Kral.* The results are likely to be used as a guideline and have the potential to be employed as a new source of antioxidants and antimicrobials.

2. Materials and methods

2.1 Reagents and chemicals

Methanol, ethanol absolute, chloroform ($CHCl_3$), n-butanol, petroleum ether, ethyl acetate, and ultrapure water were supplied by VWR Merk (France), while folin-ciocalteu reagent, Diphenyl-1 picrylhydrazyl (DPPH), BHT, chlorogenic acid, gallic acid, and catechin were supplied by Sigma–Aldrich Inc. (Paris, France). For the purpose of determining the level of microbial activity, reagents such as nutrient agar and sabouraud dextrose agar are used.

2.2.Plant material

In March of 2014, samples of the air parts of *Haloxylon articulatum Bioss, Arnebia Decumbens Vent Coss and Kral* plants were gathered in Douilatte, OuedSouf (33° 07" 00" N 7° 11' 00" E). This species was first identified by Professor Gerraf Noureddine, who works in the Laboratory of Biomolecules and Plants at Larbi Ben Mhidi University in Oum El Bouaghi. Before being utilized for medicinal extraction, the leaves were first allowed to air-dry in well-ventilated rooms at room temperature, then ground into a powder, and then passed through a sieve with a mesh size of 0.750 millimeters.

2.3. Usingchromatography analysis; extract the active " polyphenol" from *Haloxylon articulatum Bioss* and *Arnebia Decumbens Vent Coss* and *Kral* plants.

2.3.1. *Haloxylon articulatum Bioss* and *Arnebia Decumbens Vent Coss and Kral* plants were used to extract polyphenol.

Following the drying process, the plants will be weighed after being crushed in a well-ventilated chamber away from direct sunlight (100 g).The recovered plant material will be macerated in a hydroalcoholic combination (70/30; V/V) of methanol and water. This maceration procedure was repeated three times, with the solvent being replaced every 48 hours. The methanolic extract is coloured with warm distilled water after going through the filtration and concentration procedure, and the residue is kept in the solution overnight before being filtered. After being filtered, the solution underwent several rounds of liquid-liquid extraction using solvents of progressively higher polarity, beginning with petroleum ether and ethyl acetate and concluding with n-butanol [18, 19].

2.3.2. High-performance liquid chromatography analyses (HPLC)

For the purpose of separating and identifying phenolic chemicals, a high-performance reverse phase liquid chromatography system (Agilent Technologies 1260, Germany) was utilized. This system was outfitted with a UV diode array detector (DAD), as well as a chromatographic column that was packed with grafted silica gel of the octadecyl type ZorbaxEclipse XDB-C18 (4.6 x 100 mm, 3.5 microns).While the temperature of the column was kept at 25 degrees Celsius, the detector (DAD) was adjusted such that it would scan from 200 to 400 nm for each of the various extracts. The volume of the injection is 20 ul, and the mobile phase is composed of two different solvents denoted by the letters A and B. Solvent A is methanol, while solvent B is milliQ water with 0.1% formic acid. The pace of this phase is going to be at 0.4 ml/min. The gradient elution separation technique was the one that was employed, and **Table 1** outlines the software that was used throughout the process.

For the purpose of identifying polyphenol and flavonoid components, a comparison was made between the retention times of peaks obtained for those flavonoids' standards that

were injected under the same chromatographic circumstances [20, 21].

Table1: Gradient elution

Temps (min)	*Solvent A (%)*	*SolventB (%)*
0	10	90
5	20	80
10	30	70
30	50	50
40	60	40
45	70	30
50	90	10
55	50	50
60	10	90

2.4 Total polyphenol content determination (TPC)

For the purpose of determining the total phenolic content of each butanol extract, the Folin reagent developed by Ciocalteu was used (FCR). After combining a diluted solution of acid gallic in methanol at a concentration of 0.3-0.03 mg/ml with 0.5 mL of folin-Ciocalteu reagent, 0.8 mL of sodium carbonate was then added to the mixture (7.5 percent). The reaction mixture was allowed to incubate for half an hour in a room with low lighting. A UV-visible spectrophotometer with the wavelength set at 765 nm was used to get an absorbance reading for the product of the combination. We determined the total phenolic content of the extracts by calculating the milligrams of gallic acid equivalent (GAE) present in each gram of dry extract.The calibration curve's obtained correlation coefficient was R^2 = 0. 999. All of the findings are means (standard error of the mean) and were assessed in three replications. We deal with various prepared solutions (butanol extracts) at varied concentrations in the same manner we deal with gallic acid [22, 23].

2.5 Total flavonoidsdetermination (FVT)

As reagents, we made use of sodium nitrite, which is a colorless solution ($NaNO_2$, 5%), and aluminum chloride, which was diluted to a concentration of 10%. The flavonoids in the sample are oxidized by these molecules, which leads to the formation of a brownish complex that has an absorbance of 510 nm. This is the assumption upon which the technique is based. The total quantity of flavonoids in methanol, which is a dilute solution of catechin (range: 0.3-0.03 mg/ml), may be determined by using the optical density that was acquired from a catechin sample with a known concentration as a reference. In each test tube, we poured in 500 milliliters of catechin solutions of varying concentrations. After that, we poured 75 l of a solution containing 2.5% sodium nitrate at a time. After waiting for 5 minutes, 125 liters of $AlCl_3$ with a concentration of 10% was added. This was followed by the addition of 500 liters of NaOH with a concentration of 1% and 500 liters of distilled water. The reaction mixture was then incubated in a dark room for 30 minutes until the reaction was finished. Using catechin solutions that are considered to be standard, a calibration curve may be generated at varying concentrations. Using a UV-visible spectrophotometer, the absorbance of the resultant combination is directly measured at 510 nm, and the results are expressed as mg catechin equivalent/g dry matter (EC/g DM).Three distinct experiments were used to examine the results. The calibration curve's achieved correlation coefficient was R^2 = 0. 998, and the acquired data were provided as mean (SEM). We deal with the other prepared solution (butanol extracts) for various concentrations in the same manner, we deal with catechin [24, 25].

2.6. The antioxidant activity of the extracts is determined.

For the purpose of determining antioxidant capability, one may evaluate a substance's ability to either identify the

products of oxidation or capture reaction-model radicals. The first method demands that you have prior knowledge of the compounds that are oxidized. In point of fact, these methodologies examine the derivatives of the initial components in search of aldehydes, ketones, and dicarbonyl groups. During the second phase, a number of radical antioxidants that had been trapped are connected. These dual modes and forms of expression are advised for use when putting into practice the percent inhibition (IC) and/or equivalency standards for polyphenols that were obtained by UV-visible spectroscopy. When determining the antioxidant activity of a sample, the percentage of inhibition is determined by using the following method to calculate the value:

The ability of a chemical extract to scavenge free radicals and, as a result, delay or prevent the generation of free radicals is evaluated by measuring the extract's capacity to capture free radicals. Comparing the absorbance of the targeted samples to that of a calibration straight line that relates the absorbance to the standard concentration is the method that is utilized when determining whether or not equity standard polyphenols are appropriate for use in the evaluation of antioxidant activity. The antioxidant activity of leaf extracts may be evaluated using a variety of different types of radicals, including the reducing power, the radical ABTS test, the radical OH, and the DPPH radical [13, 26, 27].

2.6.1.Phosphomolybdenum test for total antioxidants (TAC)

During this test (PPM), the reducing material supplies the oxidizing complex with hydrogen and electrons, which are then transferred to the oxidizing complex (extract-antioxidant). This particular transfer method is affected by both the redox potential of the medium's pH as well as the structure of the antioxidant molecule. The molybdenum reduction in the sixth stage (VI) of the oxidation state is what the test is based on (V). This reduction is quantified by observing how much color the molybdenum (VI) complex loses in the presence of an antioxidant, which is demonstrated by the creation of a complex that has a greenish hue (phosphate/Mo (V)) when the pH level is acidic.Unlike previous essays, this one allows you to measure not just the antioxidant activity of polyphenols, but also the antioxidant activity of other antioxidants including vitamins. Acid gallic dissolved in methanol (0.2-0.02 mg/ml) was used to make different concentrations. 0.2 mL of each acid gallic concentration in an Eppendorf tube were combined with 2 mL of a reactive compound comprising H_2SO_4 (0.6 M), NaH_2PO_4 (28 mM), and ammonium molybdate (4 mM). The tube is then sealed and incubated for 90 minutes at 95 degrees Celsius. The absorbance is measured at 695 nm after cooling. The calibrators, controls, and samples all go through the identical incubation process. The findings are given in milligrams of gallic acid equivalents per gram of dry matter (EAG mg/g). The data are reported in milligrams equivalent to gallic acid per gram of dry matter (mg EGA /g) since the curve was created using gallic acid as a reference. With a correlation value of $R^2 = 0.998$, the calibration curve is established [13, 28]. We deal with the other prepared solution (butanol extracts) for varying concentrations, in the same manner, we deal with gallic acid.

2.6.2. The DPPH test

The DPPH test (2, 2-diphenyl-1-picrylhydrazyl) is a popular technique for determining antioxidant activity. The capacity of the DPPH to create stable free radicals is one of its main characteristics. The translocation of free electrons in the molecule is responsible for the molecule's stability. Because of the presence of DPPH radicals, the solution has a dark purple colour and absorbs light at 517 nm. The decrease of DPPH radicals by an antioxidant agent causes the tested solution to discolour. The antioxidant capability is assessed in the following way: We generate various quantities of phenolic extracts of plants dissolved in methanol (range 0.15625-1.25mg/ml) in 0.1 mM of a solution of DPPH (M=394g/mol) in a volume 100 ml of methanol. Moreover, we prepare 0.5 ml of each concentration of phenolic extracts in test tubes by adding a 0.5 ml DPPH solution. After that, the mixture was placed in a dark room (away from light) for 30 minutes. At 517 nm, the absorbance is measured. We use the same

procedure to compare the effectiveness of plant extractions using the chemical BHT as witnesses of reference.Both the preparation of the sample and the control are carried out under the identical conditions. Using spectrophotometry, one may detect a decrease in absorbance, and one can calculate the IC% (percent inhibition) by using the formula that is provided below:

It is usual practice to express antiradical activity using the notation IC_{50} (mg/ml), which refers to the amount of antiradicalaire that must be administered in order to induce a 50% inhibition. The data are all presented as averages (SEM), and each variable was analyzed three times. Altering the concentration of the extracts while simultaneously calculating the percentage concentration of each associated IC allowed for the discovery of linear regression between the different concentrations and IC%. As a consequence of the prediction, the proper value for IC_{50} A may also be derived [29].

2.7. Assays for antimicrobial activity

2.7.1. Microorganisms

This research employed a total of nine bacterial cells, four of which were gram-positive bacteria cells and five of which were gram-negative bacteria cells. *StaphylococcusaureusATCC*6816, *Staphylococcusaureusméthicillinerésistante*, *BacilluscereusATCC14579*, and *ListeriamonocytogenesATCC19115* were among the gram-positive bacteria tested. *KlebsiellapneumoniaeCIP104727*, *Klebsiella pneumonia CIP105705*, *EscherichiacoliATCC*25922, *Salmonellatyphimurium, andseudomonasaerigunosaATCC27853*were employed as gram-negative bacteria.The strains were donated by the Laboratory of Bioactive Substances, the Center for Biotechnology in BorjCedria (CBBC), and BP 901—HammamLinf—2050, all of which are located in Tunisia.

2.7.2 Conditions of incubation

Bacteria were cultivated in nutrient agar for 24 hours at 37°C, whereas yeasts were cultured in sabouraud dextrose agar (SDA; 4 % dextrose, 2%neopeptone, and 1.7 % agar) for 24-48 hours at 30°C [13].

2.7.3 Assay for disc diffusion

Butanol plant extracts from *Haloxylon articulatum Bioss*, *Arnebia decumbent sVent Coss and Kral* were dissolved in water and methanol at a ratio of 50:50, then filtered through a 0.45-micron membrane filter and final concentrations of 1, 0.1, and 0.01 mg/ml were achieved. The antibacterial activity was determined by using a technique known as disc diffusion. This technique required the use of 100 liters of suspension that contained 108 colony-forming units (CFU) per milliliter of each microbe, as well as 20 milliliters of nutritional agar specifically designed for bacteria. This mixture was then placed in a Petri dish that had been sterilized with filter paper (7 mm in diameter).

We soaked the disks in a Petri dish with varying quantities of phenolic extracts, with one disk serving as a reference and being saturated with methanol at a ratio of 50%. We incubated it at 37 degrees for 24 hours while holding it in an inverted position in the incubator. In order to simulate this process, an antibiotic produced in a laboratory was employed. The diameter of the inhibitory zone that surrounded each disc was measured three times, and each time it was repeated.**Table 2** shows that the extracts of the plant have no effectiveness against the remainder of the bacteria, including *ListeriamonocytogenesATCC19115*,*KlebsiellapneumoniaeCIP104727*,*KlebsiellapneumoniaeCIP105705*, *Salmonellatyphimurium*, and *PseudomonasaerigunosaATCC27853*, which all have active null.These findings will be compared to antibiotic outcomes against the germs under investigation.

Table2 : Antibacterial Activity of phenolic Extracts of *Haloxylon articulatum Bioss*. and *Arnebia Decumbens Vent Coss* and *Kral* Plants and antibiotic

Diameter of zone inhibition(mm)

Microorganisms Bacteria	phenolic extract from *Haloxylo narticulatum Bioss*(BF_3)	phenolic extract of *Arnebia Decumbens Vent Coss and Kral*.(HF_3)	polymyxin B	Ampicillin
Staphylococcus aureus ATCC 6816	(10±0.3)	(13±0.6)	12.5 ± 0.5	27 ± 1.2
Staphylococcus aureus méthicilline résistante	(13±0.5)	(14±0.6)	11 ± 0.4	18 ± 0,9
Bacillus cereus ATCC 14579	(17±0.6)	(8±0.6)	8.5 ± 0,1	16 ± 0,8
E. coli ATCC 25922	(20±0.6)	(18±0.4)	19 ± 0,6	12 ± 0,2

2.8. Statistical analysis

In order to analyze the data, statistical tests were utilized, and the results were afterwards presented in the form of mean values and standard deviations (SD). All of the analyses in this study were carried out three times due to the fact that the measurements were all carried out over three separate studies. As a result of the fact that all of the measurements were gathered from three separate trials, this study's analyses were all carried out three times. The statistical computations were carried out with the help of the OriginPro version 8 software (Prolab), and the Pearson correlation coefficient and the bivariate correlations test were utilized to establish the existence of correlations. The level of significance was determined to be 0.05. As a consequence of this, the derived value minus the P value (0.05) was regarded as statistically significant, whereas P values that were lower than 0.01 were regarded as being extremely statistically significant.

3. Results and discussion

3.1. Yield of Extract

Butanol is a solvent that has lately been employed in various research to extract substantial amounts of phenolic chemicals. When compared to other solvents, it is said to be the most effective. **Table 3** indicates the extraction yield (g/100 g dry weight), the mass yield obtained for a phenolic extract of plant *Haloxylon articulatum Bioss* is found to be 3.9% , and plant *Arnebia Decumbens Vent Coss* and *Kral* is found to be 10.25 %.

Table 3 : Mass yield of leaves obtained by butanol of varieties of *Haloxylon articulatum Bioss.*and *Arnebia Decumbens Vent Coss and Kral*

Plant species	dry weight extract g/100 g of plants powder
Haloxylon articulatum Bioss.	3.9 ± 0,07
Arnebia Decumbens Vent Coss and Kral	10.25± 0,17

*The mean and standard deviation of three separate experiments are used to calculate the results.

3.2. HPLC for identification

The majority of plants extract *Haloxylon articulatum Bioss*. and *Arnebia DecumbensVent Coss and Kral*, HPLC were used to identifying compounds phenolic extracts by comparing their retention periods to those obtained for the same standard compounds.

3.2.1.Identification of compounds phenolic of plant *Haloxylon articulatum Bioss* by HPLC

This comparison demonstrated that the majority of flavonoids were present, including resorcinol, which had a retention time of 15.86 minutes, luteolin 7-Oglucoside, which had a retention time of 29.397 minutes, Hyperoside, which had a retention time of 31.212 minutes, Nobilétine, which had a retention time of 32.192 minutes, and myricetin, which had a retention time of

34.334 minutes, at rates of 0.45 mg/g of plant extract and 1.5214 mg/g.

Minor peaks with retention times ranging from 8.577 min to 27.657 min are most likely phenolic compounds called "gallic acid" with a rate of 0.06 mg/g plant extract and trans-hydroxycinnamic acid with a rate of 1.889 mg/g plant extract. The calibration curve is used to determine the levels of polyphenols and flavonoids found in plant extracts (see **Fig. 1** and **Table 4**). (areas of highest concentration as a function of the total amount of standards)

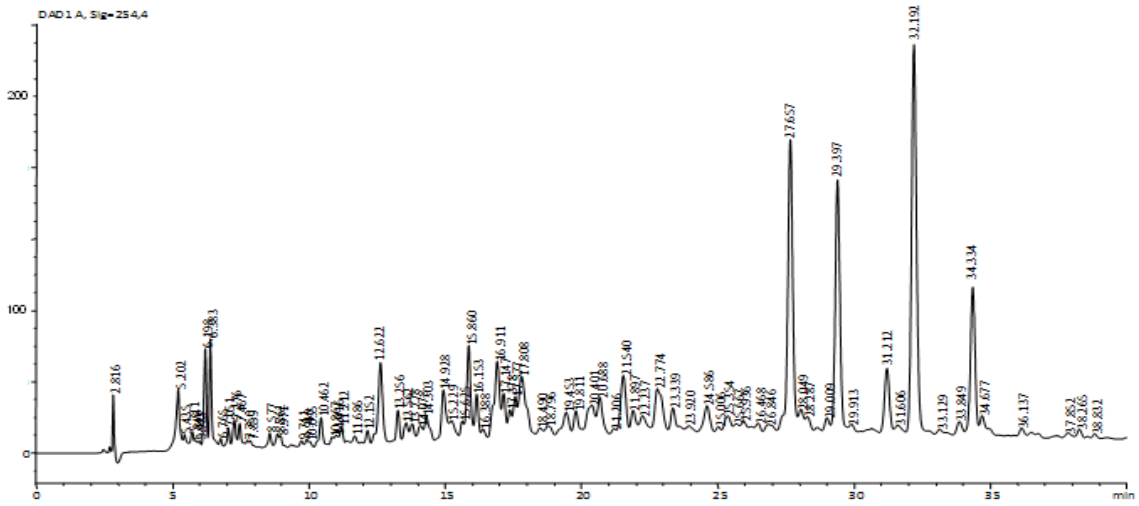

Fig.1: HPLC profile of leaves extract from *Haloxylon articulatum Bioss* recorded in UV at 254 nm

Table 4: Quantification of phenolic and flavonoids compounds identified in a butanoic extract from plant *Haloxylon articulatum Bioss.*

Retention time (min)	area	Identification	Quantification mg/g
8.577	32.5	GallicAcid	0.06
10.462	16.25	Catechin	0.0299
15.860	241.3	Resorcinol	0.45
27.657	1024.1	Trans- hydroxycinnamicacid	1.889
29.397	852	Luteolin 7-O glucoside	1.5214
31.212	221.8	Hyperoside	0.409
32.192	1363.4	Nobiletin	2.5155
34.334	470.2	Myricetin	0.8671

3.2.2 Identification of compounds phenolic of plantextract*ArnebiaDecumbens Vent Coss and Kral*by HPLC

This comparison confirmed the presence of the majority phenolic compounds of gallic acid with retention times ranging

from 8.597 min to 1.2738 mg / g, and compounds p-coumaric acid with a retention time of 24.015 min, coumarine with a retention time of 25.848 min, and trans-hydroxycinnamic acid with a retention time of 27.6 min, with rates of 2.029 mg /g and 1.6496 mg /g and 0.18mg /g.

Minor peaks with retention times ranging from 10.326 min to 31.212 min are likely flavonoids compounds. Catechin has a rate of 2.452 mg /g, luteolin 7-Oglucoside has a retention time of 29.46 min, and Hyperoside has a retention time of 31.212 min, with rates of 0.1464 mg /g and 0.2895 mg /g of plant extract, respectively. Using the calibration curve, the levels of polyphenols and flavonoids found in plant extracts may be determined (see **Fig. 2** and **table5**). (areas of greatest peak as a function of the amount of standards present).

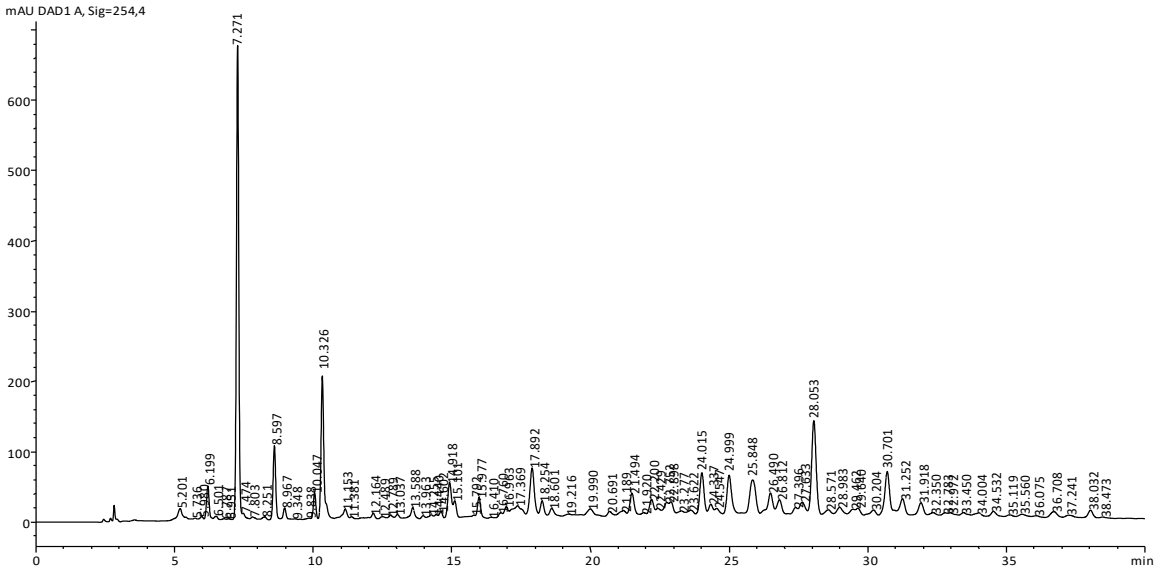

Fig. 2: HPLC profile of leaves extract from *ArnebiaDecumbensVent*.and*karl* recorded in UV at 254 nm

Table 5: Quantification of phenolic and flavonoids compounds identified in butanoic extract from plant *ArnebiaDecumbens Vent Coss and Kral*

Retention time (min)	area	Identification	Quantification mg/g
8.597	690.4	Gallicacid	1.2738
10.326	1493.3	Catechin	2.452
24.0.15	625.6	*p*-coumaricacid	2.029
25.848	715.8	Coumarin	1.6496
27.6	100	Trans – hydroxycinnamicacid	0.1844
29.46	82	luteolin 7-O glucoside	0.1464
31.25	157	Hyperoside	0.2895

3.3. Phenolic and flavonoid totals

Methods for calculating total phenolic content. In the case of the first plant, the outcome was as follows: (*Haloxylon articulatum Bioss*) The total phenolic content of various extraction procedures ranges from 114.30.254 mg EAG/g to 12.0250.245 mg EC/g, whereas flavonoids content varies from 12.0250.245 mg EC/g. With the same procedure, the findings for the second plant, *Arnebia Decumbens Vent Coss and Kral*, vary from 229.450.343 mg EAG/g, while the

concentration of flavonoids in catechin equivalent ranges from 9.180.23 mg EC/g Ms. **Table 6** shows the findings of quantitative polyphenol and flavonoid analyses in extracts of the leaves of the varieties *Haloxylon articulatum Bioss*. and *Arnebia Decumbens Vent Coss and Kral*. These results indicate that the extract from the leaves of *Haloxylon articulatum Bioss*. and *Arnebia Decumbens Vent Coss* and *Kral* was high in polyphenols and flavonoids.

Table 6. Total Phenolicand Flavonoids Content of Plant Extracts of Region OuedSouf

Plant extracts	Total phenolic (mg GAE/g Ms)	Flavonoids content (mg EC/g Ms)
Haloxylon articulatum Bioss.	114.3±0.254	12.025±0.245
Arnebia Decumbens Vent Coss and Kral	229.45±0.343	9.18±0.23

3.4. Estimation of antioxidant activity of the plant extracts

3.4.1. Estimate of Total antioxidant by phosphomolybdenum (TAC)

The main principle to assess antioxidant capacity through phosphomolybdenum test includes reducing Mo(VI) to Mo(V) whereby plants extracts that contain Antioxidant compounds [30], the total estimation to the effectiveness of Antioxidant for the whole extracts can be expressed with the symbol TAC, by using the standard Gallic acid curve, the total efficacy can be calculated with milligrams for Gallic Acid in each gram of dry weight of plant extract (mg/g), and the results have revealed in **Table7**.

Table 7. The Activity Antioxidant total by phosphomolybdenum (TAC) of plant extracts of region OuedSouf

Plant extracts	TAC (mg EAG /g)
Haloxylon articulatum Bioss (B.F)	141.3± 2.5
Arnebia Decumbens Vent Coss and Kral(H.F)	324.15 ± 3.43

The Antioxidant efficiency (molybdenum test) in B.F extracts was calculated at 141.3 2.5 mg EAG /g, which is regarded as less effective than H.F, which was estimated at 324.15 3.43 mg EAG /g, which is considered more effective than Antioxidant.

3.4.2. Antioxidant activity as measured by DPPH radical scavenging

The task at hand Both Saharan types of plants from the area OuedSouf, the extract *Haloxylon articulatum Bioss*. and *Arnebia Decumbens Vent Coss and Kral*, have radical trapping DPPH leaves. Prospectively, the highest value (IC_{50} = 2.49, 0.067g/ml) and (IC_{50} = 1.45,0.061g/ml).The antioxidant capacity of several species of plants, such as *Haloxylon articulatum Bioss* and *Arnebia Decumbens Vent Coss and Kral*, is greater than even the conventional BHT (IC_{50}=11.7 ,0.7 g/ml) due to a large number of polyphenols in our extracts.

The results strongly supported the extract of the plant from the area of OuedSoufhigh antioxidant activity, as shown in **Table 8**.

Table 8. The Activity trapping DPPH radical (IC_{50} in µg/ml) extract of plant Saharan region OuedSouf and BHT standards.

Plant extracts and standard	DPPHIC_{50}(µg / ml)

Haloxylon articulatum Bioss.	2.49 ± 0.067
Arnebia Decumbens Vent Coss and Kral	1.45±0.061
BHT	11.7 ± 0.7

3.5. Antimicrobial activity

The antibacterial activity of phenolic extracts of studied plants against Gram-positive (*Staphylococcus*aureus*ATCC6816*, *Staphylococcus aureus méthicilline résistante, Bacillus cereus ATCC 14579, Listeria monocytogenes ATCC 19115*) and Gram-negative *(Klebsiella pneumoniae CIP 104727, Klebsiella pneumoniae CIP 105705, Escherichia coli ATCC*the diameter of inhibition surrounding the discs is measured after reading the data (see **table 9**)

Table 9. Inhibition of Growth of Highly Resistant Bacterial by a Plant Extracts of *Haloxylon articulatum Bioss* and *Arnebia DecumbensVent Coss and Kral* .

Microorganisms Bacteria	**Diameter of zone inhibition(mm)**			
	extracts phenolic of plant *Haloxylon articulatum Bioss* (BF_3)	extracts phenolic of plant *Arnebia Decumbens Vent Coss and Kral*(HF_3)	polymyxine B	Ampicillin
Staphylococcus aureus ATCC 6816	10 ± 0.3	13 ± 0.6	12,5 ± 0,5	27 ± 1,2
Staphyloccocus aureus méthicilline résistante	13 ± 0.5	14 ± 0.6	11,0 ± 0,4	18 ± 0,9
Bacillus cereus ATCC 14579	17 ± 0,6	8 ± 0,6	8,5 ± 0,1	16 ± 0,8
E. coli ATCC 25922	20 ± 0,6	18 ± 0,6	19 ± 0,6	12 ± 0,2

3.5.1. Study the effect of extracts on *Staphylococcus aureus ATCC 6816*

From the results, it is clear that both of extracts phenolic BF_3 andHF_3 revealeddiameters of inhibition on the growth of bacteria assessed with 10±0.3 mm and 13±0.6 mm respectively. It represents the diameters of inhibition less than diameters inhibition of Ampicillin. However, we noted that diameters of inhibition of HF_3 higher than diameters inhibition of Polymyxin B on the growth of bacteria *Staphylococcus aureus ATCC 6816.*

3.5.2. Study the effect of extracts of bacteria *Staphylococcus aureus methicillin-resistant*

From the results, it is clear that both of extracts phenolic BF_3 andHF_3 revealeddiameters inhibition on the growth of bacteria assessed with 13 ± 0.5 mm and 14 ± 0.6 mm respectively. It represents the diameters inhibition less than diameters inhibition of Ampicillin. However, we noted that diameters inhibition of BF_3 andHF_3 higher than diameters inhibition of Polymyxin B on the growth of bacteria *Staphylococcusaureus methicillin-resistant.*

3.5.3. Study the effect of extracts on bacteria *Bacillus cereus ATCC 14579*

From the results, it is clear that both of extracts phenolic BF_3 andHF_3 revealeddiameters inhibition on the growth of bacteria assessed with 17 ± 0.6 mm and 8 ± 0.6 mm respectively. Regarding BF_3, its diameters inhibition value is higher than both diameters inhibition of Ampicillin and Polymyxin B. however, the value of HF_3 diameters inhibition value is less than both diameters inhibition of Ampicillin and Polymyxin B on the growth of bacteria *Bacillus cereus ATCC 14579*.

3.5.4. Study the effect of extracts on bacteria *E. coli ATCC 25922*

From the results, it is clear that both of extracts phenolic BF_3 andHF_3 revealeddiameters inhibition on the growth of bacteria assessed with 20 ± 0.6 mm and 18 ± 0.4 mm respectively. Regarding BF_3, its diameters inhibition value is higher than both diameters inhibition of Ampicillin and Polymyxin B. however, the value of HF_3 diameters inhibition value is less than Polymyxin B and higher than diameters inhibition of Ampicillin on the growth of bacteria *E. coli ATCC 25922.*

4. Conclusion

The current study comprises the recognition of plants that grow in southeastern Algeria (EL-Oued). Where we studied two plant species (*Haloxylon articulatum Bioss* and *Arnebia decumbens Vent Coss and Kral*) that are used in medical treatments. And in our study, we were able to discover important substances in this plant (with percentage difference) of which there are active products like (polyphenols) where we extracted them. This study sets up the reaction of the phenolic substances on the activity of the antioxidant and the reaction of the latter in the antibacterial activity. With the chromatography (HPLC), the phenolic extract was discovered. And to obtain exact results of the substances, the quantitative study was used where the overall quantitative results of the phenolic components of the extracts studied were more in the plant *ArnebiadecumbensVentCoss and Kral* (229.45EAG / g).At the overall amount of flavonoids was more in the plant *Haloxylon articulatum Bioss* (12.025 mg/g). After the analysis, the study showed that the phenolic extracts give a high antioxidant activity with chemical tests. Where we used two chemical tests; -Test DPPH - Total Antioxidant Potency (TAC) "Molybdenum Reduction Test".

The activity value is measured with the DPPH root, where tests indicated that the IC_{50} value of the phenolic plant extract *Arnebia decumbens Ven Coss and Kral*, was 1.45µg / ml, and the concentration values minimal was for the phenolic extract of the plant *Haloxylon articulatum Bioss* 2.49µg / ml and for the BHT component of 11.7µg / ml. These results show the importance of plant extracts in future experiments as they were more effective than industrial antioxidants.For the H.F extract of the plant *Arnebiadecumbens VentCossand Kral*, the tests indicated more antioxidant efficacy. Where it was noted that the overall capacity of the latter is 324.15mg EAG / g.We then noted a positive relationship between antioxidant efficacy results and the overall content of phenolic components extracted from the plants studied (*ArnebiadecumbensVentCoss and Kral* and *Haloxylon articulatum Bioss*). While antioxidant efficacy increases with increasing phenolic components and this in *Arnebia decumbens Vent Coss and Kral* are compared with *Haloxylon articulatum Bioss.* These results also reveal a high antibacterial efficacy of the phenolic extract of the plant *Haloxylon articulatum Bioss.* Where we concluded that the inhibitory effects of phenolic extracts are greater than in the antibiotics studied (Polymyxin B, Ampicillin) against the bacterium *E. coli ATCC25922* and *Bacillus cereus ATCC 14579.* This is due to the large activity antibacterial of phenolic extract from plant *Haloxylon articulatum Bioss,* which contains flavonoids more than *Arnebia decumbens Vent Coss and Kral.*

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Conflict of Interest:

The authors state that there are no commercial or financial links between themselves and anybody else that may be considered as a possible conflict of interest in the study that was carried out by them.

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