



## The antibacterial activity of water extracts of *Traganum nudatum* Del (Chenopodiaceae) growing in Algeria

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### ABSTRACT

Disk diffusion and micro-dilution techniques were used to determine the antibacterial activity of water extracts of three parts (roots, stems and leaves) of *Traganum nudatum* against five clinical bacterial strains: (*Escherichia coli*, *Staphylococcus aureus*, *Streptococcus Sp*, *Salmonella typhis*, and *Pseudomonas aeruginasa*). The inhibition zone varies depending on bacterial species and type of extract. The average diameter of inhibition zones ranges from 0 to 24 mm, 0 to 12.5 mm and 0 to 19 mm for roots, stems and leaves extracts, respectively. The MIC value of roots extract was 0.0625 mg/ml against *Escherichia coli*, *Streptococcus sp*, and *Staphylococcus aureus*, while that of stems extract was 0.125 mg/ml against *Escherichia coli* and *Streptococcus sp*. As far as leaves are concerned, the MIC value was 0.0625 mg/ml against *Escherichia coli* and 0.10 mg/ml against *Streptococcus sp*, and *Staphylococcus aureus*. In general, the obtained results showed that the antibacterial activity of *Traganum nudatum* extracts was more effective against Gram-positive bacteria than Gram-negative. Phytochemical screening of the plant revealed the presence of alkaloids, tannins, saponins and flavonoids.

### INTRODUCTION

Plants are able to produce different compounds that be used to protect themselves against different types of pathogens [1]. Interest in medicinal plants has revived because of current problems associated with the use of antibiotics [2]. Spices are mainly used in foods mainly because they give desirable flavours and aromas; in addition, it shows antimicrobial activity [3] Medicinal plants are important elements of indigenous medical systems in Algeria as well as in other developing countries. *Traganum nudatum* (chenopodiaceae) is a medicinal plant famous for its therapeutic effect in Algerian southern part. It is used to cure some diseases such as diarrhoea, rheumatism, curing wounds ...etc [4].

The plant has not been previously subjected to any biological study in spite of its wide use in the folk medicine. The present study deals with antibacterial activity of water extract of three parts (roots, stems and leaves) of *Traganum nudatum* against five clinical bacterial strains

(*Escherichia coli*, *Staphylococcus aureus*, *Streptococcus Sp Salmonella typhi*, and *Pseudomonas aeruginosa*). The study was carried out using disk diffusion and micro-dilution techniques.

## MATERIALS AND METHODS

**Plant Material:** *Traganum nudatum* roots, stems and leaves were collected around Ouargla, south east of Algeria and authenticated at the Department of Biology by Dr. Chahma A.Madjid, University of Ouargla. A voucher specimen was deposited at the Herbarium for reference purposes. The plant parts were air-dried and then ground before use.

**Extraction Procedure:** The dried and powdered plant parts (500g each) were subjected to water maceration overnight. Extracts were concentrated to dryness in vacuum and weighed. Each extract was transferred into clean and dried airtight vials until ready for use.

**Phytochemical Screening:** Samples of *Traganum nudatum* roots, stems and leaves were screened phytochemically for the presence of secondary metabolites using the standard methods of Harbone,[5] and Trease and Evans [6]. The secondary metabolites screened for are alkaloids, tannins, saponins, anthraquinones, flavonoids, Sterols and triterpenes, Steroid derivatives, and cardenolides

**Bacterial Strains:** The organisms used in this study were three Gram-negative and two-Gram positive bacteria. The organisms were obtained from the Microbiology laboratory, SAIDAL, Dar Elbeida Algeria.

**Antimicrobial activity:** The antimicrobial activity was determined by the well diffusion method [7]. Wells of (6 mm diameter) were made in Mueller Hinton agar. Plates were seeded with a 24 h old culture of the bacterial strains. Plant extracts were added to the wells at a concentration of 5 mg/well. Triplicates of each concentration for each bacteria species were prepared. The inoculated plates were incubated at 37 °C for 24 h. The diameter of the inhibition zones were measured for each plate and the average reading of the three replicates for each antibacterial species are shown in Table 2.

Minimum inhibitory concentration (MIC) was determined by the microdilution method [8]. The bacterial inoculum size was adjusted to the turbidity of the 0.5 #1McFarland standard so as to deliver a final inoculum of approximately  $10^5$  colony-forming units (CFU/ml). Using a micropipette, 50µl of the standard microbial broth culture were introduced into the wells. The test plates were incubated at 37°C for 18 h. The endpoint (MIC) is taken as the lowest concentration of drug at which the microorganism tested does not show visible growth.

## RESULTS AND DISCUSSION

Qualitative phytochemical screening of the extracts of *Traganum nudatum* demonstrated the presence of Alkaloids, tannins, saponins and flavonoids while anthraquinones, cardinolides, Sterols and triterpenes were absent.

The results of the antibacterial screening of the plant (Table 2) revealed that the three extracts showed varying degrees of inhibition on the tested microorganisms at a concentration of 5 mg mL<sup>-1</sup>. The Roots extract showed a great activity against *Escherichia coli*, *Staphylococcus aureus* and *Streptococcus Sp* (17 -24mm) but no activity against *Pseudomonas aeruginosa* and *Salmonella typhis*. The stems extract exhibited higher activity against *Escherichia coli* and

*Streptococcus Sp* (11–12.5mm) whereas there is no activity against *Staphylococcus aureus*, *Salmonella typhis* and *Pseudomonas aeruginosa*. The Leaves extract had an important activity against *Escherichia coli*, *Staphylococcus aureus* and *Streptococcus Sp* (16 -19mm) but no activity against *Pseudomonas aeruginosa* and *Salmonella typhis*. The minimum inhibitory concentration of the different extracts ranged between 0.0625 and 0.125 mg mL<sup>-1</sup> (Table 3). The lowest MICs for extracts were those for *Streptococcus Sp*, *Staphylococcus aureus*, and *Escherichia coli* (0.0625 mg mL<sup>-1</sup>).

**Table 1: Phytochemical components of the water extracts of *T. Nudatum***

| Phytochemical components | roots | stems | leaves |
|--------------------------|-------|-------|--------|
| Alkaloids                | +     | +     | +      |
| Tannins                  | +     | +     | +      |
| Saponins                 | +     | +     | +      |
| Anthraquinones           | -     | -     | -      |
| flavonoids               | +     | +     | +      |
| Sterols and triterpenes  | -     | -     | -      |
| Steroid derivatives      | -     | -     | -      |
| cardenolides             | -     | -     | -      |

**Table 2: Inhibition zone diameter (mm) of different extracts at 5mg/mL**

| organisms                     | Roots extract | Stems extract | Leaves extract |
|-------------------------------|---------------|---------------|----------------|
| <i>Escherichia coli</i>       | 24            | 11            | 16             |
| <i>Pseudomonas aeruginosa</i> | 0             | 0             | 0              |
| <i>Salmonella typhis</i>      | 0             | 0             | 0              |
| <i>Staphylococcus aureus</i>  | 23            | 0             | 19             |
| <i>Streptococcus Sp</i>       | 17            | 12.5          | 16             |

**Table 3: Minimum inhibition concentration (MIC) of different extracts of *T. Nudatum***

| organisms                     | Roots extract | Stems extract | Leaves extract |
|-------------------------------|---------------|---------------|----------------|
| <i>Escherichia coli</i>       | 0.0625        | 0.125         | 0.0625         |
| <i>Streptococcus Sp</i>       | 0.0625        | 0.125         | 0.10           |
| <i>Staphylococcus aureus</i>  | 0.0625        | -             | 0.10           |
| <i>Salmonella typhis</i>      | -             | -             | -              |
| <i>Pseudomonas aeruginosa</i> | -             | -             | -              |

The antibacterial activity of the water extracts of *Traganum nudatum* can be attributed to the action of the phytochemical compounds it contains. Polyphenolic compounds are known to inhibit a wide range of organisms [9]. The antimicrobial activity of the extracts could be explained by the presence of tannins. The mechanism of action of tannins is based on their ability to bind proteins thereby inhibiting cell protein synthesis [10]. There was a significant difference in the antimicrobial activity of the extracts on Gram-negative and Gram-positive bacteria since there was no biological effect against *Pseudomonas aeruginosa* and *Salmonella typhis* with the prescribed concentration. The roots have been found to be more effective against *staphylococcus aureus* and *Escherichia coli* than stems and leaves. The three extracts did not show any action against *Pseudomonas aeruginosa* and *Salmonella typhis*. This means that higher doses of the antimicrobial agent will be needed in the treatment of infections caused by *Pseudomonas aeruginosa* and *Salmonella typhis* provided they are not toxic to the tissues.

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