

## Effect of climate on some morphological and chemical characteristics of the plant *Glycyrrhiza glabra L.* in two arid regions of southern Algeria

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### ABSTRACT

This study was conducted to determine the impact of environmental factors on the morphological and chemical properties of a medicinal plant belongs to the legume family known as licorice (*Glycyrrhiza glabra L.*) in two regions of southern Algeria (Tougourt and Biskra).

We concluded from this study that the morphological (stem length and leaf area, leaf number) of licorice affected by various climatic factors, particularly the amount of precipitation.

The temperature and precipitation affect the rate of sugar in the roots, where high temperatures lead to increased perspiration process of the latter, which has an impact on chemical reactions and thus the amount of sugars in the plant. Ultimately, we concluded that environmental factors influence the accumulation of active substances glycoside inside the plant, where Tougourt exclusively against Biskra greater quantity of it (4,53% et1, 96%) successively.

**Key words:** *Glycyrrhiza glabra L.*, active substances, glycoside, sugar, climate.

### INTRODUCTION

In Algeria, the vast space, natural conditions (climate and soil), a large number of plant species that provide medicinal resources particularly rich (Anonymous, 1983).

The general term "herb" also covers a wide range of plant from perfectly edible plants real killer that need to be wary all costs (Debuigne and Couplan, 2009).

Medicinal plants owe their action one or more active principles that can be chemically analyzed and it is essential to know to understand how they act on the body (BenHamza, 2008).

Licorice (*Glycyrrhiza glabra L.*) Is a perennial plant of the family Fabaceae, subfamily faboidées to aromatic roots? It is native to southern Europe and Asia (Caël, 2009).

It is a herbaceous plant measuring 1 to 1.5 m high. It has large pinnate leaves composed of 9-17 leaflets small purple flowers arranged in inflorescence. His fruit pod is flat 2 to 3 cm long, containing numerous seeds (Small 2011).

The roots and rhizomes of licorice have complex physiological properties from different active ingredients that have been isolated and the chemical structure and the Therapeutic actions are well known (Girre, 2006).

Climatic conditions, such as time of day, precipitation and outside temperature, have a significant influence on the physical qualities, chemical and biological medicinal plants (Endrias, 2006).

The aim of this work studies the climatic effects on morphology and analysis chemical *Glycyrrhiza glabra L.* (The dosage of sugar and glycoside and the surface

and number of leaves and stem length) comparisons between two zones of Biskra and Touggourt.

## MATERIAL AND METHODS

### Introduction to the study area :

Our practice has obtained samples of two plants or area are: Oumache and Touggourt.

### Da Delineation study area Oumache (Biskra)

The center is located off Oumache 20 km south of Biskra, and 35 km southeast of Tolga, it covers an area of 828 km<sup>2</sup> and 53 so it is the largest town in wilaya of Biskra it is a percentage of 23.27% of the Daira of ourlal and 3.79% surface of wilaya.

### Delimitation of the study area Touggourt:

Touggourt, the historic capital of the region of Oued Righ between the great Erg Eastern and south-eastern area chotts north.

Touggourt area is located between latitudes 32° North, 54° and 34, 9 and longitudes 5° and 6° 30, 20. altitude is close to 70 m. La total surface area is 481 km<sup>2</sup> From an administrative point of view daïra Touggourt currently belongs to the wilaya Ouargla is located 600 km south-east of Algiers in the North Eastern Sahara. (Labeled *et al.* 2011).

### Determination of soluble sugars

Total soluble sugars (sucrose, glucose, fructose and their methyl drift polysaccharides) are determined by the method of Dubois and the other by Herbert (1971).

### Glycoside extraction:

When the plant *Glycyrrhiza glabra L.* is containing glycoside was looking to chemical for this work is the method of (Faouzi, 1979) and (Balbaa, 1981) which is: 10 g of *Glycyrrhiza glabra L.* Taking (Root) powder and master in alcohol (70%) then in rad capacitor pendant 30 minutes, also repeated three times for each juice samples' qua extracting all glycosides. It can be checked by using Fehling solution (experience of presence glycoside).

Filtering the solution and the filtrate was diluted with distilled (common volume) water.

To avoid dyes and lipids (fat), alkaloids and other non-metals glycoside. Then add 100 ml of concentrated acetate leads to the subject of sediment is last. By filtration was obtained an alcoholic solution and the glycoside comprises over lead acetate. It can lead acetate removed by sedimentation as lead sulfide and is passed through the sodium phosphate (Na<sub>3</sub> PO<sub>4</sub>).

One in three filtration th both eliminated lead sulfide and also obtained on the filtrate with adition 20 ml of chloroform (three times) and to justify the extraction of all glycosides can be verified by the sulfuric acid. And there is no easy way to eliminate the soft chloroform method and evaporation is carried out by rotary evaporator.

Finally we are at brute. et glycosides calculated performance.

### The quantitative content of crude glycoside

This study a comparison abuts the amount of glycosides in the roots of licorice between two areas, the area Oumache and Touggourt area., and so we designed the effect of temperature and precipitation.....ect for this was the established steps preceding schematics glycoside extract were weighed before the ball is empty after

the extraction was weighed the ball to the 2nd time deference between the weight is the content of crude glycoside.

Note: the weight was repeated several times, and then calculates the average.

**VI-processing and statistical analysis**

To determine the significance of the parameter studied applied treatments we conducted analyzes of variance and comparison of means to each treatment using statistical software (MINITAB series 13.31.2000) and present these results in the form of histograms and curves (EXEL). The leaf area per picture Tools (version 3) software we measured.

**RESULTS AND DISCUSSION**

**Results:**

**The climate classification:**

**Diagram Ombrothermic Gausson:**

The relationship between seasonal variations of the two main ecological factors, temperature and precipitation, are particularly embodied by the diagrams said Ombrothermic (shadow, rain) (Hadj Youcef and Hamed, 2008).

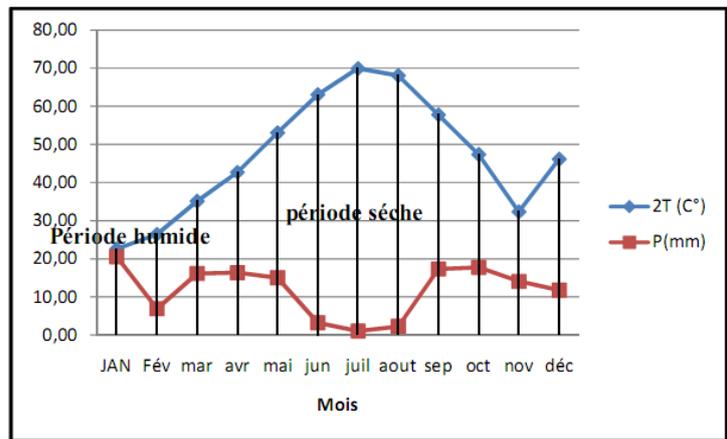


Fig. 1: Diagram of Ombrothermic Gausson applied to the region Oumache (Biskra) (2000-2011).

The climate of Biskra is hot and dry in summer, cold and dry in winter.

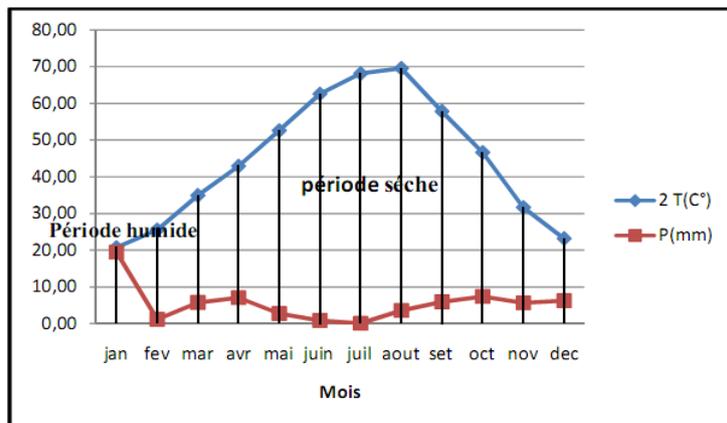


Fig. 2: Diagram of Ombrothermic Gausson applied to the region Touggourt (2000-2011).

The climate of the region is Touggourt Sahara, as characterized by a long dry season.

**Comparison between climate Oumache(Biskra) and Touggourt**

**Rate of precipitation:**

From the Fig. (3) shows the histogram of the precipitation rate in two regions, deference is observed between the two regions, and also we can see that Increased precipitation Oumache throughout the year by providing the region Touggourt, it decreased during winter.

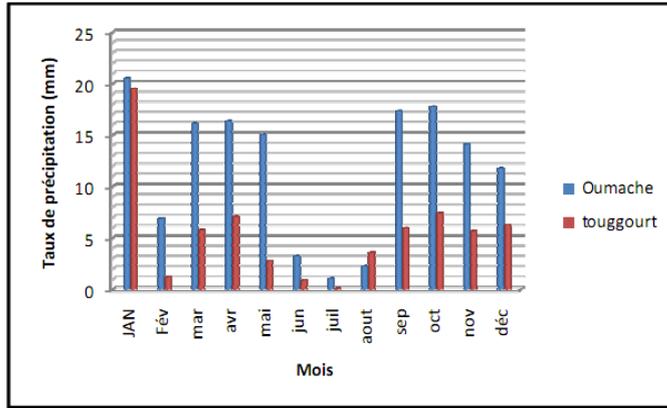


Fig. 3: Histogram for the precipitation rate (2000-2011) in the region of Oumache (Biskra) and Touggourt.

**Rate temperature**

From the Fig. (4) the temperature at the same rate throughout the month of December in the year soft Touggourt this region characterized by low temperature.

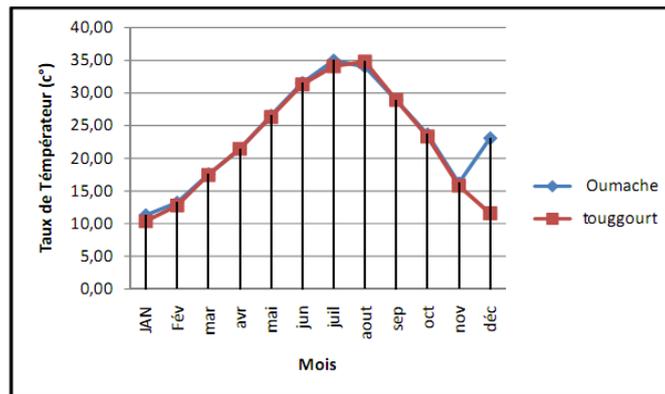


Fig. 4: The rate of temperature for (2000-2011) in the region Oumache (Biskra) and Touggourt.

**The length of the rod Licorice:**

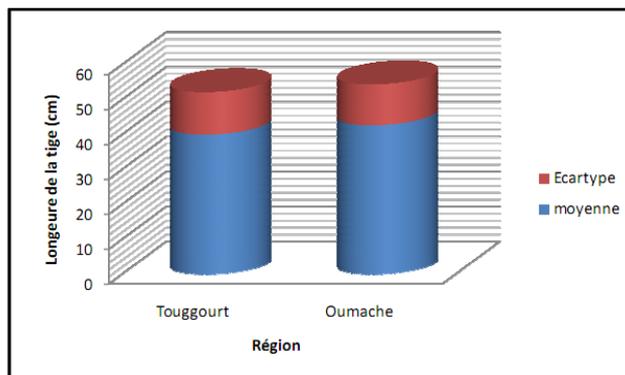


Fig. 5: Histogram of the length of the rod licorice in two regions Touggourt and Oumache(Biskra).

The analysis of variance shows that there is a significant effect between the two regions

Among our results we classified the length of the rod:

- The first region: Oumache is higher than the rod length Licorice (42.67 cm).
- The second region: Touggourt which is characterized by the small length of rod (40cm).

**The number of sheets of Licorice:**

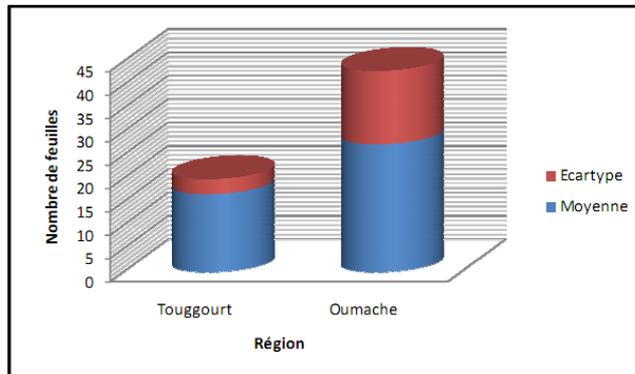


Fig. 6: Histogram of number of sheets of Licorice in two regions Touggourt and Oumache (Biskra).

According to the analysis of variance to be found in this study that there is a significant effect between region.

Among our results we classified the number of sheets:

- The first region: Oumache is higher than the number of leaves (27.33).
- The second region: Touggourt which is characterized by the low number of sheets (16,67).

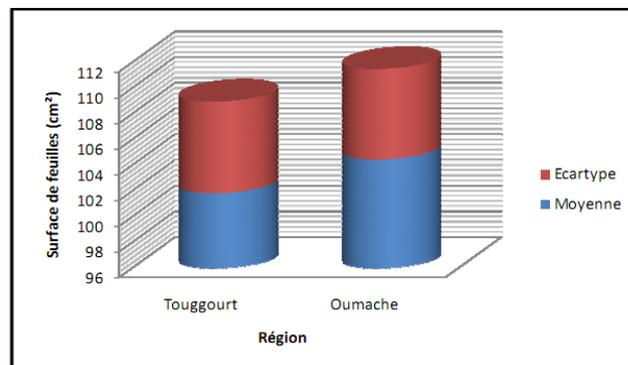


Fig. 7: Histogram of leaf surface of Licorice in two regions Touggourt and Oumache(Biskra).

The statistical study shows that there is a significant effect between régions Parmi our results were classified surface sheets:

- The first region: Oumache is higher than the surface of leaves (104.47 cm<sup>2</sup>).
- The second region: Touggourt which is characterized by the lower surface sheets (101.9 cm<sup>2</sup>).

### Quantitative content of sugar Licorice:

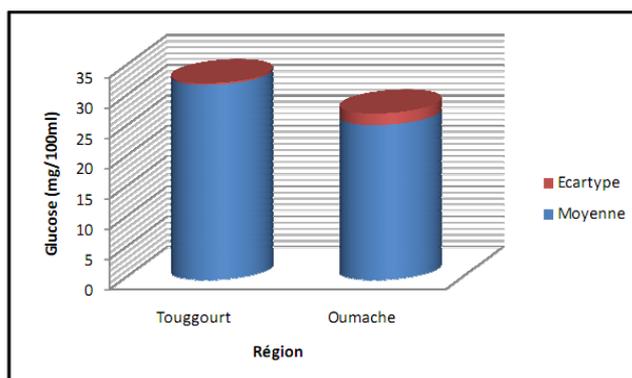


Fig. 8: Histogram analysis dosage of sugar in two regions Touggourt and Oumache (Biskra).

Analysis of variance showed a significant effect on the sugar accumulates in Licorice root Among our results we classified the sugar content:

- The first region: Touggourt is the high sugar content in the roots (32.20mg / 100 ml).
- The second region: Oumache which is characterized by low sugar content (25.57 mg/100 ml).

The analysis of variance is to be found in this study that there is a significant effect on the percentage of glycosides in the roots of Licorice.

### Quantitative content of crude glycoside Licorice:

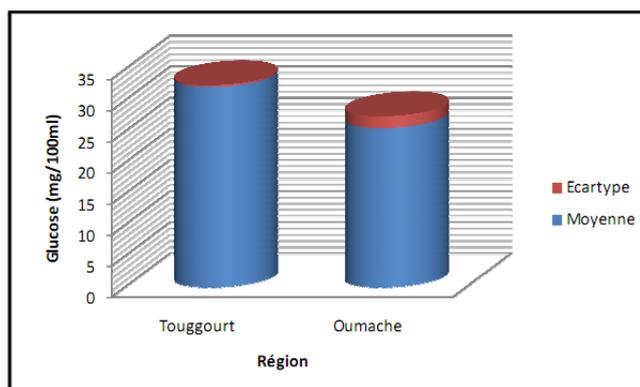


Fig. 9: Histogram percentage of glycosides in two regions Touggourt and Oumache (Biskra).

## DISCUSSIONS

Climatic conditions, such as time of day, precipitation and outside temperature, have a significant influence on the physical, chemical and biological medicinal plants. Sunshine duration, the average height of rainfall, average temperature and thermal amplitude between day and night also influence the physiological and biochemical activity of plants. It is important to predetermine all of these factors (Endrias, 2006).

Water is an important agent that acts on the growth of plants in general and medicinal plants included, our limited study of arid and we choose the plant *Glycyrrhiza glabra* L.

It is clear that the length of the rod in the Licorice Oumache station is higher than that of Touggourt.

- The number of sheets in the Licorice Oumache station is higher than in Touggourt.
- The surface sheet in the Licorice Oumache station is higher that of Touggourt.

Vegetation to adapt to their environment to survive and water shortages being the most important limiting factor, desert plants have changes Morphological that enable them to withstand the lack of moisture and long periods of drought. These changes include the following: training stems and fleshy leaves that store water can be stored; disappearance leaves, or reduction of the surface, or thickening of the cuticle to lower transpiration rate (Chopra *et al.*, 1960).

A Touggourt during the previous 10 years, according to climate data from this last there was an increase in temperature and a decrease in average precipitation. The temperature has a direct or indirect effect on plant growth.

This can increase the interpreted length, the number and the surface sheet Oumache in the area.

We propose a second factor that affects plant morphology Liquorice from climatic data was the precipitation rate in the area that Oumache is higher than Touggourt.

According CAËL (2009), includes the Licorice Glucose (up 4%), fructose, maltose, sucrose (2,4-6, 5%).

Products of primary metabolism, mainly saccharides, essential the life of the plant, which are formed through photosynthesis is photosynthèse. la process by which plants use light energy to manufacture, in part carbon dioxide, the carbohydrates become the primary material of their substance vital. The reaction of photosynthesis allows to penetrate the carbon in the life cycle (Bernard, 1999).

The primary metabolism is influenced by several environmental factors such as temperature, humidity, wind, precipitation, compared with climate data temperature and precipitation between the two regions and Touggourt Oumache, we remark the difference in precipitation. This shows the increase in glucose assay.

Touggourt area, and the influence of the high temperature causes the sweating and losing a considerable amount of water that has an effect on metabolism.

The active ingredient considered one of the results of the indirect photosynthesis, which has effects of the active ingredients in the plant, we talk about some conditions photosynthesis include temperature and humidity.

When talking about the temperature in (Heikal and Abdallah, 1993). The temperature effect on photosynthesis, but also has an effect on the degradation of Chemical compounds and synthetic food, while the construction of any which chemical compound in the plant is based on the total difference between the results of photosynthesis and degradation of these compounds.

There is the influence of the active ingredient by the temperature rise more or less increases. In *Capsicum annum* L., increasing the temperature augment content of alkaloids kabsine fruit, dry and decreased with temperature.

In *Datura stramonium* L., increasing temperature decreases contains their alkaloid.

It appears that the glycosides are more condensed in the station that Touggourt Oumache station of this variability is evidenced by the effect of climatic factors as in Touggourt during previous 10 years, according to climate data Touggourt it Recorded the increase in the temperature and decrease of the average precipitation.

(And Mohamed Heikal, 1990) states that plants harvest afternoon contain values glycoside higher compared to plants harvested in the morning.

As *Glycyrrhiza glabra* L. persisted in areas where rainfall is very low and could be grown in many arid regions of mime that *Balanites aegyptiaca*, which is particularly suitable for places where resistance to séchersse is the limiting factor (Ozenda, 2004). The Licorice glycoside comprises (2-15%) by Ayoub (2008).

When talking about the importance of water and its effect on the active ingredient of the plant depending on the type of plant and the active ingredient obtained plant observed *Citrullus colocynthus* L. the perm irrigation increases the active ingredient contains water and decreases contains their glycoside as in *Coriandrum sativum* L.

The rate of essential oils increase in climate in wet areas (Mohamed and Tahani 1990).

What can interprets the dimunition of glycoside in the plant *Glycyrrhiza glabra* L. In the region Oumache. as decreasing temperature and the increase in from moisture and precipitation permentent increased water contains in the plant and cause dimuniation of them contains glycoside.

## CONCLUSION

The analysis of climate data and the use of diagram Ombrothermic Gausson, show a simple difference between the climate in two zones, the temperature is the same in both regions, but the precipitation is different; Oumache is than Touggourt, these results confirm the effect on climate change morphological in quantities of glucose and glycoside Licorice root.

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#### ARABIC ABSTRACT

تأثير العوامل المناخية على بعض الخصائص المورفولوجية والكيميائية لنبات عرق السوس (*Glycyrrhiza glabra* L.) في منطقتين جافتين جنوب الجزائر.

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أجريت هذه الدراسة لمعرفة تأثير العوامل البيئية على الخصائص المورفولوجية والكيميائية لنبات عرق السوس (*Glycyrrhiza glabra* L.) في منطقتين من جنوب الجزائر (قوت وبسكرة). لوحظ من خلال هذه الدراسة إلى أن الخصائص المورفولوجية (طول الساق و مساحة الورقة وعدد الأوراق) لنبات عرق السوس تتأثر بمختلف العوامل المناخية وخاصة كمية التساقط. هذا وقد كانت للحرارة و التساقط تأثير على نسبة السكريات في الجذور، حيث أن الحرارة المرتفعة تؤدي إلى زيادة عملية النتح هذا الأخير الذي له تأثير على التفاعلات الكيميائية و بالتالي على كمية السكريات في النبات. وفي الأخير اتم استنتاج أن للعوامل البيئية تأثير على تراكم المواد الفعالة الجليكوسيدية داخل النبات، حيث انفردت قوت مقارنة ببسكرة بأكثر كمية منه بـ (4,53% و 1,96%) على التوالي.