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Phytochemical study of Algerian Opuntia ficus-indica

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ABSTRACT

Some chemical compounds distribution in three parts (cladodes, flowers and seeds) belonging to Cactaceae family were assessed and compared. The plant investigated was Opuntia ficus-indica Mill (pickly pear), which were found to contain flavonoids, tannins, reducing compounds and fatty acids. Coumarins were absolutely absent in tree parts of the plant. Alkaloids were present in the seeds of Opuntia ficus-indica but absent in cladodes and flowers unlike anthocyaosids and anthracenodis wich were present in flowers but absent in cladodes and seeds.

Keywords: Opuntia ficus-indica Mill, phytochemical constituents, essential oil, Tannins, flavonoids, Alkaloids, Saponins.

INTRODUCTION

Cactus pear or pickly pear, a member of the cactaceae family, which is widely distributed in Mexico, has the widest germplasm variability as well as the highest number of uses, and also grows in several other parts of the world such as Africa, Australia, the Mediterranean basin, and some parts of Asia. It was dispersed around the globe during the two centuries after the arrival of Christopher Colon to the Americas in the late 15th century. Nowadays it can be found in North and South Africa, the Near East and as far as inland China [1, 2, 3].

It is used in traditional medicine and as a source of vegetal nutriments in many countries. It is claimed to be an excellent source of natural oligoelements which may improve human health and nutrition [4].Cactus extracts have shown anti-tumoral [5] and anti oxidant activities [6,7].

MATERIALS AND METHODS

The plant studied was harvested in April 2011 in the region Ain-Youcef of Tlemcen (Algeria), it was identified at the laboratory of Ecology and Management of Natural Ecosystems of the University of Tlemcen (Algeria).

The three plant parts (cladodes, flowers and seeds) are dried and finely ground using a coffee grinder to allow a good extraction of plant constituents, then stored in glass vials protected from light.

The researches of organic compounds are performed on different extracts prepared from different parts of the plant. During the phytochemical examination, three solvents of different polarity (water, diethyl ether, ethanol) are used for the extraction of different families of chemical compounds.

Preparation of ethanolic extract: The ethanolic extract was prepared by a mixture of 50 g dried powdered samples in 300 mL of ethanol under reflux for1h. The extract is filtered by using Whatman filter paper. The filtrate was used for phytochemical screening.

Test of flavonoids: Treat 5 mL of alcoholic extract with a few drops of concentrated HCl and 0.5 g of magnesium turnings[8].

Test of tannins: In a test tube,1 mL of ethanolic solution was added to 2 mL of water and 2-3 drops of diluted solution of FeCl3and observed for a green, a blue black or a blue - green coloration, which shows the presence of tannins[9].

Test for alkaloids: 20mL of the extract was added to 5mL of HCl (10%). At this acidic medium heated in a water bath, was added a volume of NH4OH (10%) until obtain a medium of pH= 9which was extracted with diethylic ether and concentrate with a rotary evaporator. The residue will be taken in 0.5 mL of HCl (2%), divide into two equal parts. The first was treated with a few drops of Mayer's reagent and the second with Wagner's reagent. Observation: turbidity or precipitation[10].

Test for sterolicheterosides and triterpenicheterosides: Amixture of 0.5mLof acetic anhydride and 0.5mL of CHCl3 was added to the residue obtained after evaporation of ethanolic solution (10mL). The filtrate was treated with Liebermann's reagent Burchardt. If a solution is blue - green appears, it indicates the presence of sterolichetero sides if it is violet- green, it indicates the presence of triterpenicheterosides[11].

Test for reducing compounds:2 mL of aqueous solution was added at 1 mL of the alcoholic solution and 20 drops of Fehling's solution, heat the solution. A brick red precipitate marks the presence of carbohydrates **[9]**.

Test of coumarins:15mL of HCl (10%) was added to 25mL of ethanolicsolution, and heated under reflux for 30min and strain the mixture. The residue was extracted with 15 mL of etherin triplicate. Divide the filtrate into three equal parts, evaporate the first in a rotary evaporator, dissolve the residue in 1mL of water and divide the volume into two parts, treat the first with 0.5mLNH4OH (10%), examined under ultra-violet light, fluorescence intensity indicates the presence of coumarins. The second one was used as control **[12]**.

Test of anthracenosides: 8 mLof the ethereal solution was treated by extractive reagent Bornträger. A positive test is revealed by the appearance of a color ranging from bright orange - red to purple – purple[12].

Test of anthocyanosides: The acidic aqueous solution was treated with NaOH. The presence of anthocyanins was confirmed by a red color at pH under 3 and blue color at a pH between 4 and 6[12].

Preparation of diethyl ether extract: The extract was prepared by a mixture of 50 g dried powdered samples in 300 mL of diethyl ether under reflux for 1h. The extract is filtered by using Whatman filter paper. The filtrate was used for phytochemical screening.

Test of volatile oils: The residue obtained after evaporation of 20 mL of ethereal solution was dissolved in ethanol and concentrated.a residual aroma reveal a positive test **[13]**.

Test of alkaloids bases: The resulting residue obtained was dissolved after evaporation of 10 ml of the ethereal solution in 1.5 mLof HCl 2% and add 1-2 drops of Mayer or Wagner reagent. The appearance of yellowish white precipitate indicates the presence of alkaloid bases[10].

Test of fattyacids: The alkaline aqueous solution was acidified, and then extracted with diethyl ether. The ethereal solution is then concentrated to dryness. A positive test is revealed by obtaining a greasy residue[13].

Preparation of aqueous extract: The extract was prepared by a mixture of 50 g dried powdered samples in 300 mL of diethyl ether under reflux for 1h. The extract is filtered by using Whatman filter paper. The filtrate was used for phytochemical screening.

Test of tannins: 1 mL of the aqueous solution was treated with 1 mL of water and 1-2 drops of dilute solution of FeCl3. The appearance of a dark green color or blue-green indicates the presence of tannins[9].

Test of saponins: 2 mL of the aqueous solution was added to a little of water and then stir in a strong way[30].Persistent foam confirmed the presence of saponins.

Abandon the mixture for 20 minutes and classify content saponins:

- No foam = Negative test.

- Foam less than 1 cm = weakly positive test.

- Moss 1-2 cm = positive test.

- Foam over 2 cm = very positive test.

Test of starch: 5 mL of solution prepared was treated with the reagent for starch. The appearance of a purplish blue color indicates the presence of starch [14].

RESULTS AND DISCUSSION

These reactions are generally simple identity, quick to implement, performed mostly in test tubes, they appear either mowing staining or precipitation, which can give an idea, according to the intensity of the result, the concentration of certain constituents. The results obtained from different organs of *Opuntia ficus-indica* are represented respectively in the following tables.

Phytochemical compound		Resultats		
		Water	Ethanol	Ether
	Flavonoids		++	
	Tannins	++	++	
Phenolic compound	Anthocyanosides		-	
	Anthracenosides		-	
	Coumarins		-	
Alkaloids	Alkaloids		-	-
	Saponins	++		
Steroids	Sterols and triterpènes		+	
Fatty acids	Fatty acids			++
Volatile oils	Volatil oils			-
Reducing compounds	Reducing compounds		+	
Starch	Starch	+		

Table 01:Phytochemical test results obtained from the cladodes of *Opuntia ficus-indica*.

Table 02: Phytochemical test results obtained from the flowers of *Opuntia ficus-indica*.

Phytochemical compound		Resultats		
		Water	Ethanol	Ether
	Flavonoids		-	
	Tannins	-	-	
Phenolic compound	Anthocyanosides		++	
	Anthracenosides		+	
	Coumarins		-	
Alkaloids	Alkaloids		-	-
	Saponins	-		
Steroids	Sterols and triterpènes		-	
Fatty acids	Fatty acids			-
Volatile oils	Volatil oils			++
Reducing compounds	Reducing compounds		-	
Starch	Starch	-		

Table 03: Phytochemical test results obtained from the seeds of *Opuntia ficus-indica*.

Phytochemical compound		Resultats		
		Water	Ethanol	Ether
	Flavonoids		++	
	Tannins	++	++	
Phenolic compound	Anthocyanosides		-	
	Anthracenosides		-	
	Coumarins		-	
Alkaloids	Alkaloids		++	-
	Saponins	-		
Steroids	Sterols and triterpènes		++	
Fatty acids	Fatty acids			++
Volatileoils	Volatil oils			+
Reducing compounds	Reducing compounds		+	
Starch	Starch	+		

The purpose of these tests is to characterize the major families of chemical compounds coexisting in different parts of the plant studied. Indeed, the method of detection of these different families is a precipitation reaction or staining reagents. These reactions result in the appearance of turbidity, flocculation or a color change that tells us about the nature of these families.

The experimental results mentioned in the previous three tables summarizing the phytochemical examination show that the starch, flavonoids, tannins, reducing compounds, steroids end sterols, fatty acids and volatile oils are present in all plant parts, in varying quantities.

Phytochemical compound		Resultats		
		cladodes	flowers	seeds
	Flavonoids	++	-	++
	Tannins	++	-	++
Phenolic compound	Anthocyanosides	-	++	-
	Anthracenosides	-	+	-
	Coumarins	-	-	-
Alkaloids	Alkaloids	++	-	++
	Saponins	-	-	-
Steroids	Sterols and triterpènes	++	-	++
Fatty acids	Fatty acids	++	-	++
Volatile oils	Volatil oils	+	+	+
Reducing compounds	Reducing compounds	+	-	+
Starch	Starch	+	-	+

Table 04 : Final results

The cladodes and seeds are rich in flavonoids, tannins, reducing compounds and sterols steroids from the flowers.

We observed the absolutely absence of coumarins in the tree parts of the plant and the presence of anthocyanosides and anthracenosides in flowers only.

Alkaloids are present in the seeds of *Opuntia ficus-indica* but absent in cladodes and flowers.

The presence of tannins in the cladodes and seeds, average amount is confirmed by a positive reaction with ferric chloride solution giving a dark green color in the cladodes (catéchists tannins) and dark green in the seeds (tannins catechists).By cons they are absent in flowers.

The seeds are rich in fatty acids from cladodes and flowers. This result is consistent with the data of Ennouri et al **[15]** on the *Opuntia ficus-indica*, as well as the results of El Mannoubi et al **[16]**.

CONCLUSION

This phytochemical study based on laboratory tests, which allowed us to characterize the family of chemical compounds that exist in our plant. Indeed, there is evidence that tannins, flavonoids, and fatty acids are present in significant quantities in the plant.

The presence of tannins, which have antibacterial activity and diarrhea in the plant explains the traditional use that is actually to treat diarrhea.

These families of compounds may be responsible for the discovery of therapeutic agents. In this context the implementation techniques of extraction, purification, separation and recrystallization and possible identification will enable the discovery of active principles.

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