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Research Article

EVALUATION OF THE ANTI-RADICAL ACTIVITY OF EXTRACTS FROM DIFFERENT PARTS OF *DATURA METEL* L. USING THE DPPH• METHOD

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Abstract

Datura metel L. is a toxic herbaceous plant of the Solanaceae family. It is distinguished by its large, trumpet-shaped flowers, which can be white or pink, and its globular fruit covered with spines. It is native to Central America, where it has naturalized in the Mediterranean and various other regions of the globe, while being cultivated as an ornamental plant. It is a plant widely used in Senegal by traditional practitioners to combat asthma, coughs, tuberculosis, and bronchitis. The seeds of *Datura metel L.* are most commonly used for the treatment of rheumatoid arthritis and seizures. Although the seeds exhibit some toxicity, they also have potent analgesic, anthelmintic, antioxidant, antimicrobial, antiviral, and antidiabetic activities. In this work, we evaluated the antioxidant activity of the different extracts. For this purpose, the different parts of the harvested plant are dried away from light, then pulverized and extracted with solvents of increasing polarity, respectively hexane, ethyl acetate, ethanol and water on the one hand and ethanol on the other hand. This was followed by the determination of the antioxidant activity of the different extracts obtained after maceration with the different solvents. The results of the antioxidant activity determined by the 2,2 diphenyl-1-picrylhydrazyl (DPPH) method showed a remarkable anti-radical capacity of certain organs of the plant with in particular relatively low 50 % inhibitory concentrations (IC_{50}) (0.2 to 2.61 mg/mL for the ethanolic extract) compared to ascorbic acid (IC_{50} is 0.085 mg/mL) which constitutes the reference antioxidant.

Keywords: Anti-Radical Activity, *Datura metel* L, DPPH●Method.

INTRODUCTION

In the Senegalese healthcare system, traditional medicine plays a crucial role. Indeed, access to medicines is a major challenge due to persistent poverty in rural areas and the high cost of modern treatments. As a result, rural and urban populations are increasingly turning to plants to which they attribute therapeutic effects that have not been scientifically proven. Consequently, more than 80 % of the world's population uses what is known as traditional medicine to treat health problems [1]. According to Cox and Balick, plants constitute a reservoir of medicines thanks to the diversity of their bioactive molecules, primarily generated as defense mechanisms against predation and infection [2]. These molecules generally possess significant pharmaceutical characteristics. For example, alkaloids have local anesthetic properties, tannins are known for their healing, antibacterial, and antiseptic properties, while flavonoids are distinguished by their anti-inflammatory and antibacterial capabilities. Saponins possess anti-inflammatory, anti-edematous, and analgesic properties, while terpenes and steroids have analgesic and anti-inflammatory effects. Quinone derivatives, on the other hand, are antibacterial [3]. Polyphenolic compounds, classified as secondary metabolites, are particularly sought after in research centers for their exceptional physiological and pharmacological activities [4].
In herbal medicine, different parts of a plant (such as roots, stems, leaves, flowers, fruits, and seeds) can be used for various purposes. *Datura metel L.* (particularly its leaves and seeds) (Figure 1) possesses anesthetic, antiasthmatic, antispasmodic, antitussive, narcotic, and bronchodilator properties.

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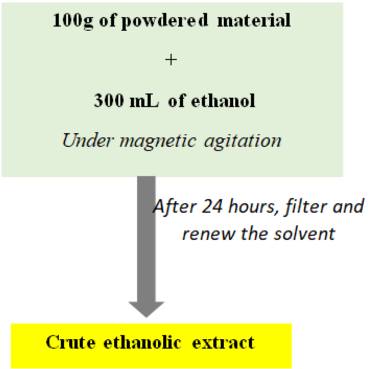
The leaves are used topically to treat rheumatic joint swelling, back pain, sciatica, neuralgia, painful tumors, as well as scabies, eczema, allergies, and glandular inflammations such as mumps. They are also used externally to treat earaches and in fumigation to soothe spasmodic asthma [5]. *Datura metel L.* (particularly its leaves and seeds) (Figure 1) possesses anesthetic, antiasthmatic, antispasmodic, antitussive, narcotic, and bronchodilator properties. Given the benefits associated with natural antioxidants and the persistent problems related to oxidative stress, the study of the free radical scavenging properties of plants has emerged as a field of specialization. This study focuses on *Datura metel L.*

MATERIALS AND METHODS

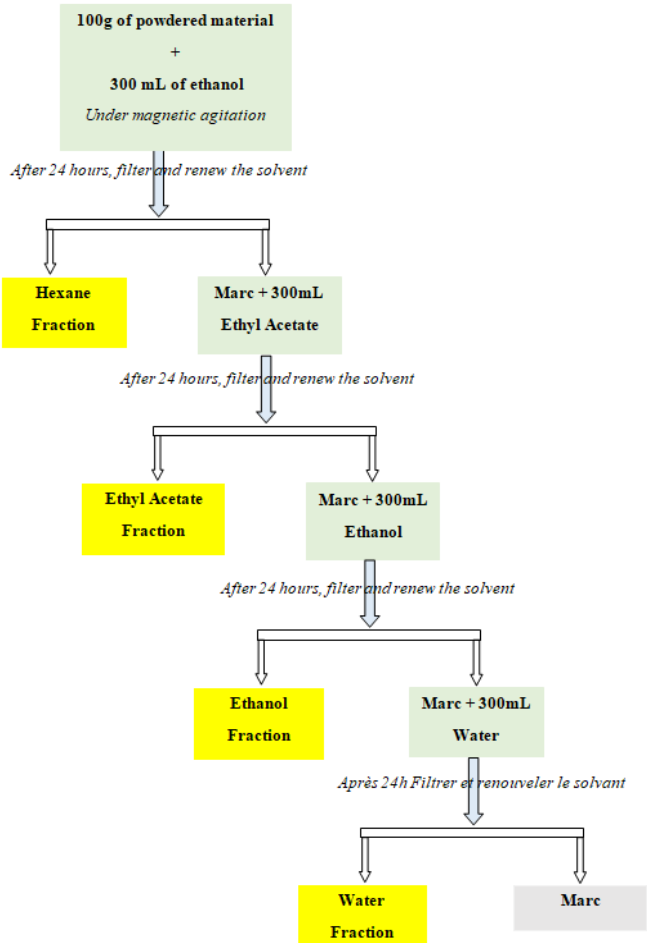
The plant material consists of the various parts of *Datura metel L.*, including leaves, flowers, stems, and seeds. The plant parts are harvested in the Thiès region, specifically in the commune of Taïba Ndiaye. After harvesting, the samples are washed, dried in the dark, and then ground into a fine powder using an electric grinder. The powders are stored in jars and subsequently macerated.

Figure 1. Image of *Datura metel L. (I. DIALLO)*

The extraction methods used are, on the one hand, crude maceration and, on the other hand, sequential maceration using solvents of increasing polarity. They are summarized in diagrams 1 and 2 below:



Scheme 1. Crude maceration using ethanol



Scheme 2. Sequential maceration using solvents of increasing polarity

The solvents from the fractions and the crude ethanolic extract obtained are then evaporated to dryness using a rotary evaporator.

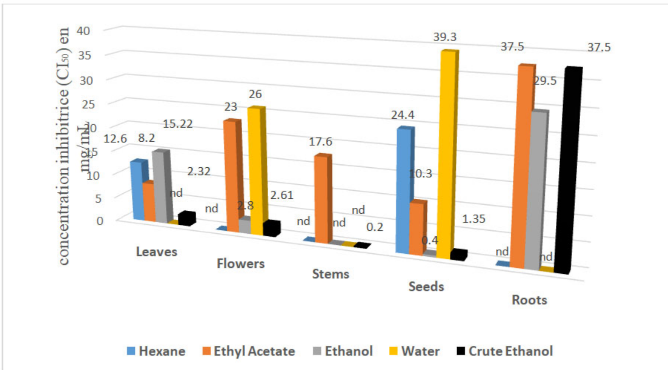
Antioxidant activity by the DPPH• method

The antioxidant test is performed using the DPPH method [6], [7]. A 40 mg/mL stock solution is prepared by dissolving 80 mg of dry extract in 2 mL of methanol. A concentration range is then prepared with a dilution factor of 1/2. A 0.2 mL aliquot of each of these concentrations is placed in test tubes and mixed with 7.8 mL of the previously prepared violet methanolic DPPH• solution. The tubes are shaken manually for a few seconds and then incubated for 30 minutes in the dark. The reading is taken using a spectrophotometer at a wavelength of 517 nm, using methanol as a blank. Ascorbic acid prepared as described above (concentration range) is used as the reference antioxidant. The DPPH• solution is obtained by dissolving 10 mg of DPPH• in 250 mL of methanol protected from light after 30 minutes of stirring.

RESULTS AND DISCUSSION

Antioxidant activity of the different extracts

The free radical scavenging activity of the different extracts was evaluated spectrophotometrically using a methanolic solution of DPPH•. This was performed by measuring the absorbance of the sample mixed with the DPPH solution at a wavelength of 517 nm, after it had been incubated for 30 minutes. Ascorbic acid was used as the reference antioxidant. Measuring the absorbances of each extract at various concentrations allowed for the determination of their associated inhibitory percentages.



nd : determined

Figure 2. IC_{50} diagram of the different organs of *Datura metel L.* in different solvents

The results obtained are represented in the diagrams to plot the regression line and determine the minimum 50 % inhibitory concentrations. If the correlation coefficient (R^2) of the regression line is less than 0.9, the extract is discarded. It is considered inactive if it fails to inhibit 50 % of DPPH within the tested concentration range. In other words, this means that the maximum inhibitory power will not reach 50 %. The results of the free radical scavenging activity of the different extracts of *Datura metel L.* are illustrated in the diagram in Figure 2.

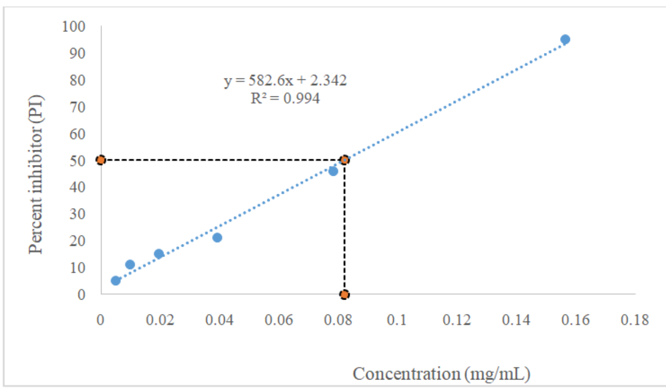


Figure 3. Ascorbic acid titration curve

Analysis of the IC_{50} values of different parts of *Datura metel L.* reveals that the crude ethanolic extract of the stems exhibits the highest free radical scavenging activity, with an IC_{50} of 0.2 mg/mL. Furthermore, it is noteworthy that the ethanolic extract of other plant parts, excluding the roots, shows the greatest free radical scavenging capacity, with IC_{50} values ranging from 0.2 to 2.61 mg/mL. The weakest free radical scavenging activities are found in root extracts, which display the highest IC_{50} values, between 29 and 38 mg/mL. Among the aqueous extracts, only the flower extract exhibits free radical scavenging activity. Since the extraction was performed sequentially with solvents of increasing polarity, this result may be due to the depletion of polar compounds by solvents such as ethanol and ethyl acetate. Indeed, the ethanolic fractions of the seeds and roots show antiradical potential with IC_{50} values of 0.4 and 29 mg/mL, respectively. This phenomenon can be attributed to the presence of lipids in the crude extract of the seeds and roots, which hinder the extraction of polyphenols. These factors are often linked to the biological activity of the molecules, leading to a decrease in their ability to neutralize $DPPH^{\bullet}$ free radicals. Furthermore, fats containing unsaturates tend to promote the formation of free radicals, resulting in reduced free radical scavenging activity. These same observations were obtained with alcoholic extracts of *Abelmoschus Esculentus L.* [8] and *Cassia Occidentalis* seeds [9]. We also observed that the crude ethanolic extract of the leaves, flowers, and stems exhibits more significant antioxidant activity than lipid-free ethanolic extracts and ethyl acetate, respectively. This supports the idea that the fats present in *Datura metel L.* seeds are responsible for the reduced antioxidant activity, whereas the leaves, flowers, and stems do not contain them. Furthermore, this information confirms the concentrations of polyphenols and flavonoids in the crude ethanolic extract compared to those in the ethanolic fraction. Comparing the antioxidant potential of *Datura metel L.* plant parts with that of ascorbic acid (0.085 mg/mL) (Figure 3), it appears that the extracts exhibit free radical scavenging activity. It is also worth mentioning that all parts of *Datura metel L.* exhibit antioxidant activity. Furthermore, the ethyl acetate extract of the leaves has greater activity than the ethanolic and aqueous extracts. The activities of the root extracts are less significant than those of the other parts of the plant.

Conclusion

The extraction method used in this work is sequential maceration with solvents of increasing polarity. Maceration better preserves secondary metabolites. *Datura metel L.* is very rich in fats; even the hexane extract of the roots contains them. This study evaluated the free radical scavenging properties of extracts from different parts of *Datura metel L.* using the $DPPH^{\bullet}$ radical method. All the studied parts of the plant exhibited varying degrees of activity. Root extracts showed the highest IC_{50} values and therefore the lowest antioxidant activity. The presence of fats led to a decrease in antioxidant activity. It would be worthwhile to further investigate this using other methods for evaluating antioxidant activity.

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