IOSR Journal of Applied Chemistry (IOSR-JAC)
e-ISSN: 2278-5736.Volume 18, Issue 12 Ser. I (December. 2025), PP 50-54
www.iosrjournals.org

Phytochemical Screening And Biological Activities Of The Ethanolic Extract Of Ricinus Communis Leaves

Omar Thiam, Ibrahima Diallo, Alioune Diouf, Nalla Mbaye, Elhadji Gorgui Diouf, Mouhamadou Fofana
Laboratory Of Organic And Bio-Organic Chemistry, Department Of Chemistry
Research Group On Bioactive Substances, Department Of Chemistry
Laboratory Of Phytochemistry And Plant Protection, Department Of Plant Biology
Faculty Of Science And Technology, Cheikh Anta Diop University, Bp 5005 Dakar, Senegal.

Abstract:
Ricinus communis is a plant native to Africa, widely cultivated in tropical and subtropical regions. It has been used since ancient times for its medicinal and industrial properties. The aim of this study is to carry out the phytochemical screening of the methanolic extract of Ricinus communis leaves and to evaluate its antioxidant and antifungal activities. The results of the qualitative phytochemical screening analysis revealed the presence of polyphenols and flavonoids. As for the biological activity, the ethanolic extract of Ricinus communis leaves showed high antioxidant activity, with an IC50 of 0.0963 mg/mL on one hand, and on the other hand it exhibited an inhibition zone of 5.31 ± 0.268 cm at a concentration of 10,000 ppm (i.e., 10 mg/mL). These results support the use of this plant in traditional medicine for certain ailments.

Keywords: *Ricinus communis, phytochemicals, antioxidant activity, antifungal*

Date of Submission: 09-12-2025 Date of Acceptance: 19-12-2025

I. Introduction

Ricinus communis is a plant native to Africa, widely cultivated in dry tropical and subtropical regions. It has been used since antiquity for medicinal and industrial purposes. Castor contains numerous chemical components, the most significant being ricin [1]. Research has focused on its potential role in treating cancers, including cervical, breast, pancreatic, and liver cancers [2]. The oil extracted from castor seeds is traditionally used in India to treat inflammation and liver disorders [1]. This plant is notable for its high nutritional value, attributed to its high content of monounsaturated fatty acids [3] and bioactive compounds such as vitamin E, phospholipids, and phenolic compounds [1]. The seeds are highly toxic due to the presence of ricin, ricinine, and lecithin. Ricin, in particular, is extremely toxic, with an oral dose of 500 mg considered potentially lethal for an adult [4]. However, methanolic seed extract has been used as an antitumoral [5], antifertility agent [6], and pesticide [7]. Given the numerous uses of *Ricinus communis*, this study aims to evaluate biological activities of its leaves, specifically antioxidant and antifungal properties.

II. Materials And Methods

Plant material

Leaves of Ricinus communis were collected in July 2024 in Zac Mbao (Dakar, Senegal). After harvesting, leaves were cleaned and air-dried for one week in the dark. The dried samples were ground into a fine powder. This step removes moisture and prevents insect contamination or fungal development.

Figure 1. Feuilles et fruits de *Ricinus communis*

Extraction

Ethanol was used as the organic solvent to extract secondary metabolites. Sixty grams of plant powder were macerated in 500 mL of ethanol for four days at room temperature and protected from light. After maceration, the extract was filtered and evaporated using a rotary evaporator, then dried to remove all solvent. The dry extract thus obtained is stored in the refrigerator until use. The extraction yield was evaluated using the formula below [9]:

Mde = mass of dry extract Mvp = mass of plant powder

Phytochemical screening

The ethanolic leaf extract was subjected to standard phytochemical tests based on color and precipitation reactions [10–12] to detect polyphenols, flavonoids, sterols and polyterpenes, leucoanthocyanins, and catechols. The $FeCl_3$ test and the Stiasny reagent allowed the identification of polyphenols, while the reaction with cyanidin was used to detect flavonoids, leucoanthocyanins, and catechols. Saponins were highlighted by the foam test, whereas the Liebermann-Burchard test was used to identify sterols and polyterpenes.

Antioxidant activity

The DPPH method was used [13]. Different extract concentrations (40 to 0.03 mg/mL) were prepared from a 40 mg/mL stock solution. To perform this test, 3.8 mL of the ethanolic DPPH solution is added to 0.2 mL of extract at different concentrations (40, 20, 10, 5, 2.5, 1.25,

0.62, 0.31, 0.15, 0.07, 0.03 mg/mL), which come from the dilution of a stock solution of 40 mg/mL [14,15]. The mixture is vigorously shaken, and the tubes are then incubated at room temperature and in the dark for 30 minutes. All readings are taken at 517 nm. The samples, reference antioxidant (ascorbic acid), and control are prepared under the same operational conditions. The inhibition percentages are estimated according to the equation:

Ab: absorbance of the blank after 30 minutes of incubation
As: absorbance of the sample after 30 minutes of incubation

The IC_{50} is the concentration of antioxidants required to inhibit or eliminate 50% of free radicals (DPPH•). They are determined from a graph of the percentage of inhibition versus sample concentrations. A linear regression line ($Y = ax + b$) is established to determine the IC50, thus characterizing the antioxidant power of the analyzed extract. A low IC_{50} value indicates high antioxidant activity [13], and consequently, a high IC_{50} value indicates low radical-scavenging activity.

Antifungal activity

Culture medium preparation

Potato Dextrose Agar (PDA) was used to prepare the culture medium. A mass of 39 g of PDA was dissolved in 1 liter of distilled water and then homogenized using a magnetic stirrer. The resulting mixture was sterilized by autoclaving for 90 minutes at a temperature of 120°C and a pressure of 1.5 bar. The culture medium, after cooling for 30 minutes, was poured into 9 cm diameter Petri dishes at a rate of 20 mL per dish. The Petri dishes were left under the hood for 48 hours to ensure that the culture medium was free of contamination before inoculation.

Evaluation of antifungal activity

The antifungal activity of the extract was tested against the *fungus Fusarium sp*. This activity was assessed based on the inhibition rate of fungal mycelial growth by the extract. Different doses were prepared by diluting the extract in 1 mL of ethanol and then making up to 100 mL with PDA solution. The negative control consisted of only 1 mL of ethanol and 99 mL of PDA. 24 hours after the doses were prepared, the tests were conducted in triplicate by placing a 1.1 cm diameter mycelial disc from a one-week-old preculture in the center of the Petri dish. These plates were incubated at 30°C in the oven. The diameters of the mycelial growth of the colonies are measured along two perpendicular axes drawn on the back of the Petri dishes. The assessment is carried out every 48 hours for one week. The calculation of the mycelial growth inhibition rate, expressed as a percentage, is given by the following formula [16]:

D: represents the mycelial growth diameter of the fungus in the control plates
d: represents the mycelial growth diameter of the fungus in the plates treated with the extracts. When no mycelial growth is observed for a specific concentration, the germ is transferred to a gelled medium without plant extract.

A resumption of growth indicates a fungistatic effect, while the absence of growth reflects a fungicidal effect [17].

Search for antifungal parameters:

- MIC (minimum inhibitory concentration): this is the lowest concentration of extract at which no growth is visible to the naked eye.
- IC_{50} (concentration causing 50% inhibition)

III. Results And Discussion

Extraction

The extraction yield of the ethanolic extract of Ricinus communis is 4.3%, which is relatively low. This suggests that the majority of the plant's secondary or primary compounds are non-polar (and there fore poorly soluble in ethanol).

Chemical composition of the extracts

Chemical Screening

The phytochemical screening allowed us to identify the different families of compounds present in the ethanolic extract. Table 1 presents the results of the phytochemical screening carried out on the ethanolic extract of castor leaves. Polyphenols, flavonoids, sterols, and polyterpenes are present in the extract, whereas leucoanthocyanins and catechols are absent. This result suggests that the ethanolic extract of castor leaves may exhibit antioxidant activities.

Table 1: Phytochemical tests of the ethanolic extract of Ricinus communis leaves

Targeted Compound Family	Ethanolic Extract
Polyphenols	+++
Flavonoids	++
Sterols and polyterpenes	++
Leucoanthocyanins	-
Catechols	-

+++: Strong staining, ++: medium staining, -: no staining

Antioxidant Activity

The absorbance values measured according to the concentrations of the extract and the standard are used to calculate the DPPH inhibitory powers.

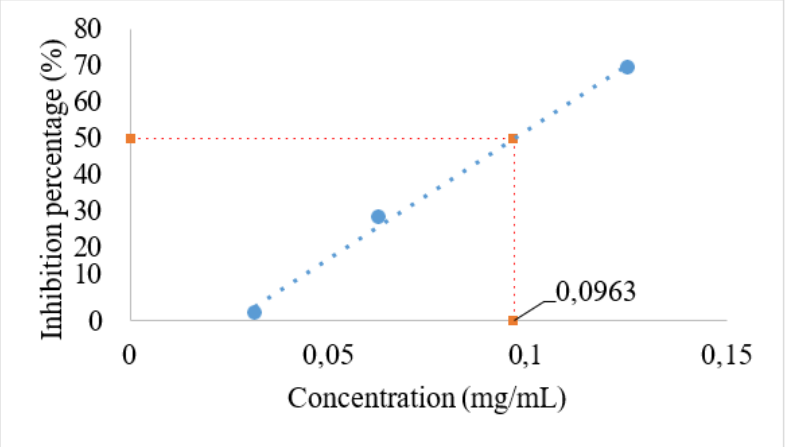

Figure 2. 50% inhibitory concentration of ascorbic acid

The IC_{50} represents the amount of antioxidant required to reduce the concentration of the free radical by 50%. It is inversely proportional to the antioxidant capacity of a compound. The antioxidant activity of a compound is high when the IC50 value is low [18]. The determined IC50 of ascorbic acid is 0.0963 mg/mL (Figure 2). The sample concentration required to inhibit 50% of the DPPH radical was calculated from the linear regression equation (Y = ax + b) of the inhibition percentages as a function of the different concentrations of extracts studied. It was also determined graphically (Figure 3). The 50% inhibitory concentration of the ethanolic leaf extract was found to be 0.830 mg/mL. The results obtained indicate that the ethanolic extract of Ricinus communis leaves shows very low antioxidant activity compared to that of ascorbic acid (0.0963 mg/mL).

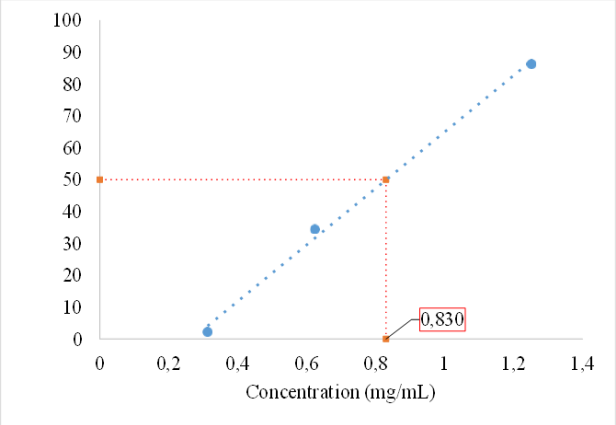

Figure 3. Determination of the 50% inhibitory concentration (IC50)

Antifungal activity

Antifungal activity reveals the presence or absence of mycelial growth. Strong growth indicates that the extract does not inhibit the growth of the tested fungus at that concentration, and vice versa. The results based on the presence or absence of an inhibition zone are shown in Figure 4.

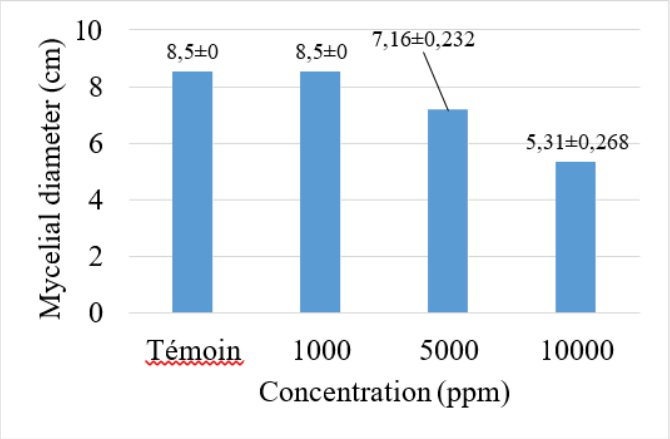

Figure 4. Inhibition diameters as a function of the extract concentration (ppm) over five days

The results obtained indicate a mycelial diameter of 8.5 cm for the control group and a decrease in diameter depending on the sample concentration after five days. A concentration of 1000 ppm does not alter the mycelial diameter. A decline is observed starting from 5000 ppm, reaching 5.31 ± 0.268 at 10000 ppm. The higher the concentration, the more the mycelial diameter decreases. This indicates that the extract slows down the growth of the fungus starting from 5000 ppm.

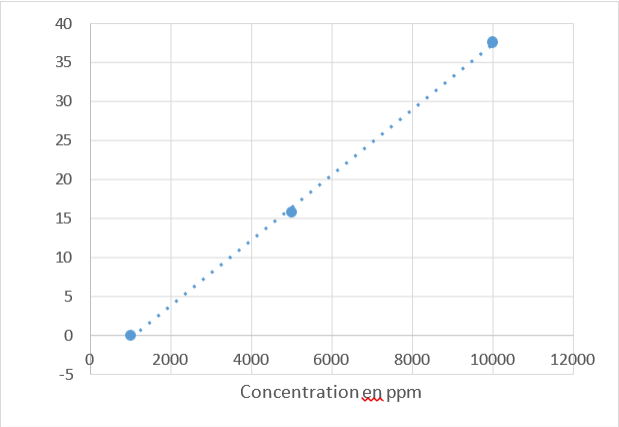

Figure 5. Average inhibition rate of Fusarium sp. mycelial growth as a function of extract concentration over five days.

The results obtained show that the control and the 1000 ppm concentration had an inhibition rate of 0%. The 5000 and 10000 ppm concentrations showed inhibition rates of 15.7% and 37.53%, respectively. This indicates that the inhibition rate increases with increasing concentration. The IC50 calculated from the regression line equation ($y = 0.0042x - 4.5169$) is approximately 12980 ppm (12.980 $g.mL^{-1}$).

IV. Conclusion

In our study, phytochemical screening showed the richness in secondary metabolites of Ricinus communis leaves. The antioxidant activity determined by the DPPH method showed a lower IC50 value (0.830 mg/mL). Studies conducted on Fusarium sp. demonstrated that the ethanolic extract exhibits an increase in the inhibition rate depending on the concentration. These results indicate that extracts of Ricinus Communis contain bioactive compounds that explain the use of this plant in the therapy of certain diseases in traditional medicine. Future investigations will focus on the purification, identification, and characterization of these bioactive compounds in order to fully exploit their therapeutic potential.

References

[1]. Said, G. Daniel, P. ; Badr, K. ; Mohamed, I. And Zoubida, C. Chemical Characterization And Oxidative Stability Of Castor Oil Cultivated In Morocco. Moroccan Journal Of Chemistry, 2016, 279-284.

[2]. [Prakash, E. And Gupta, DK, In Vitro Study Of Ricinus Communis Linn. Extracts On Human Cancer Cell Lines. J. Med. Sci. Public Health, 2014, 15-20.

[3]. Sbihi, HM ; Nehdi, IA ; Mokbli, S. ; Romdhaniyounes, M. And Alr Esayes, SI. Seed Oils And Essential Leaf Compositions Extracted With Hexane And Ethanol From Two Varieties Of Castor (Ricinus Communis L.). Crops And Industrial Products, 2018, 174-181.

[4]. Moshiri, M. ; Hamid, F. And Etemad, L. Ricin Toxicity : Clinical And Molecular Aspects. Rep. Biochem. Mol. Biol., 2016, 60-65.

[5]. Lin, JY And Liu, SY. Studies On Antitumor Lectins Isolated From Ricinus Communis Seeds (Ricin). Toxicon., 1986, 757-765.

[6]. Sandhyakumary, K. And Bobby, RG Antifertility Effects Of Ricinus Communis L. On Rats. Phytother. Res., 2003, 508-511.

[7]. Sharma, S. ; Vasudevan, P. And Madan M. Insecticidal Value Of Castor (Ricinus Communis) Against Termites. Int. Biodeterior., 1991, 249-254.

[8]. B. Sara, I. Sisaoui, And M. Soufane, "Antioxidant Activity Of Polyphenols Extracted From Two Medicinal Plants Of Jijel", 2017.

[9]. P.L. Owen And T. Johns, "Xanthine Oxidase Inhibitory Activity Of Herbal Remedies From Northeastern North America Used For Gout", Journal Of Ethnopharmacology, Vol. 64, No. 2, 1999, 149-160.

[10]. V. Houmènou, A. Adjatin, F. Assogba, J. Gbénou, And A. Akoègninou, "Phytochemical And Cytotoxicity Study Of Some Plants Used In The Treatment Of Female Infertility In South Benin", European Scientific Journal, Vol. 14, No. 6, 2018, 156-171.

[11]. F. Ronchetti, G. Russo, E. Bombardelli, And A. Bonati, "A New Alkaloid From Rauwolfia Vomitoria", Phytochemistry, Vol. 10, No. 6, 1971, 1385-1388.

[12]. K. Tuo, "Phytochemical Screening And Polyphenolic Content Of Dialium Dinklagei And Diospyros Monbuttensis, Two Ivorian Medicinal Plants Used To Treat Malaria," 2020.

[13]. P. Molyneux, "The Use Of The Stable Free Radical Diphenylpicrylhydrazyl (DPPH) To Estimate Antioxidant Activity," Songklanakarin J. Sci. Technology, Vol. 26, No. 2, 2004, 211-219.

[14]. I. Diallo Et Al., "Phytochemical Screening; Determination Of Total Polyphenol And Flavonoid Content And Antioxidant Activity Of Different Parts Of Datura Metel L.," IOSR Journal Of Pharmacy And Biological Sciences (IOSR-JPBS), 2022, 24-31.

[15]. AD Kone, B. Mbow, A. A Gaye, S. F Ndoye, And M. Gaye, "Ficus Sycomorus L. Extracts: Phytochemical Screening, Total Polyphenol And Flavonoid Content, Antioxidant And Antibacterial Activity," Science Journal Of Chemistry, 2022, 126132.

[16]. Doumbouya M., Abo K., Lepengue AN., Camara B., Kanko K., Aidara D., Koné D., Comparative In Vitro Activities Of Two Synthetic Fungicides And Two Essential Oils On Soil Fungi From Vegetable Crops In Côte d'Ivoire. Journal Of Applied Sciences 50, 2012, 3520-3532.

[17]. Kossonou Yao Kamelé Et Al. In Vitro Antifungal Activity Of Extracts From Five Local Plants On Colletotrichum Higginsianum, Fusarium Oxysporum, And Rhizopus Stolonifer, Pathogens Of Papaya (Carica Papaya L.) And Tomato (Solanum Lycopersicum L.), Nangui Abrogoua University, Abidjan, Côte d'Ivoire, V.15 N° 9, 304, 2019.