The Scientific Temper (2025) Vol. 16 (9): 4741-4744

E-ISSN: 2231-6396, ISSN: 0976-8653

Doi: 10.58414/SCIENTIFICTEMPER.2025.16.9.05

https://scientifictemper.com/

RESEARCH ARTICLE

Qualitative Phytochemical Profiling of Amaranthus Dubius Leaves

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Abstract

Amaranthus dubius belonging to the Amaranthaceae family and commonly referred to as red amaranth, is an edible leafy vegetable esteemed for its nutritional and therapeutic properties. It is extensively found in tropical and subtropical areas, encompassing India, Bangladesh, China, the Philippines, Malaysia, Indonesia, and many African nations. A. dubius has been employed in traditional medicine for the treatment of anemia, digestive disorders, inflammation, dermatological conditions, and microbiological infections. The plant is an abundant source of bioactive phytoconstituents, including alkaloids, flavonoids, phenolic compounds, tannins, saponins, glycosides, terpenoids, and steroids, as well as vital vitamins, proteins, amino acids, and minerals such as iron, calcium, potassium, and magnesium. These phytochemicals are recognized for their various medicinal effects. Leaf extracts exhibit a diverse array of pharmacological actions, including antioxidant, antibacterial, anti-inflammatory, antidiabetic, hypolipidemic, cardioprotective, and anticancer effects, highlighting their therapeutic significance. *Amaranthus dubius* serves as both a nutrient-rich vegetable and a source of bioactive chemicals, making it a viable choice for the creation of nutrients, functional meals, and plant-derived medications.

Keywords: *Amaranthus dubius*, Phytochemicals, Red amaranth, Antidiabetic, Anemia.

Introduction

Phytochemicals are naturally active molecules present in plants, now utilized in medicine and pharmacology for the identification of novel medications and therapies (Mercy & Udo, 2018). The World Health Organization's survey indicates that a significant portion of the population, particularly in poor countries, relies on plants for primary health care, with estimates ranging from sixty-five to eighty percent. This indicates that the application of plants in disease management within traditional medicine, owing to their antimicrobial and antioxidant properties, is crucial (Antibacterial, Antioxidant Activity of Ethanolic Plant Extracts of Some Convolvulus Species and Their DART-ToF-MS Profiling. Evid Based Complement Altern Med., n.d.). The origins of early medications may be traced to the pharmacological, clinical, and chemical examination of many forms of traditional medicine (Balunas & Kinghorn, 2005). For instance, people across many countries globally have the assumption that herbal medication is devoid of adverse effects, with 80% of the global population utilizing it (Butler, 2004). In modern society, microorganisms have augmented their resistance to synthetic and semisynthetic antibacterial agents (Stanković *et al.,* 2016).

Different parts of amaranths are transformed into various extracts, mixtures, and rice meals that are administered to patients as components of traditional medicine globally, particularly in Central and South America, India, and Africa, where indigenous healing practices are prevalent (Yong *et al*., 2016). Extracts from Amaranthus species have been utilized by inhabitants of the traditional Japanese Peninsula, Nepal, Thailand, and Chinese medicine to treat disorders such as diabetes, cancer, renal failure, cardiovascular difficulties, gynecological disorders, and pulmonary prions (Molina *et al*., 2017). Consequently, *Amaranthus dubius* possesses the potential to serve as a future crop for many applications and to reduce malnutrition, particularly in

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How to cite this article: Arsha, A., Pearl, J.A. (2025). Qualitative Phytochemical Profiling of Amaranthus Dubius Leaves. The Scientific Temper, **16**(9):4741-4744.

Doi: 10.58414/SCIENTIFICTEMPER.2025.16.9.05

Source of support: Nil

Conflict of interest: None.

Received: 07/09/2025 **Accepted:** 16/09/2025 **Published:** 23/09/2025

underdeveloped nations where the plant remains neglected (House *et al*., 2020).

Botanic Description

Amaranthus dubius can grow to a height of 0.8-1.2 meters with a green, succulent, branched stem. Leaves are green or red, elongated oval in shape, and about 10-12 cms long. These fast-growing annual plants produce tall spike-like inflorescences made up of many bracts which contain either male or female flowers. Both flowers are produced in abundance and are pollinated by wind, insects, bees, or butterflies. Fruits are small ovoid capsules, about 1.5mm long which opens on maturity to release a single black seed. They are resistant to poor soil conditions and pollution. But since the stems are succulent, they need regular watering. Red spinach is also susceptible to fungus, worm, and pest infections, which must be addressed quickly to keep the leaves healthy

Medicinal Uses

Various amaranth formulations are utilized in the cosmetics industry owing to their substantial nutritional benefits. Amaranth oil is rich in unsaturated fatty acids, tocopherols, phytosterols, and squalene. These compounds can assist with hair and skin issues. (Wołosik *et al*., 2013). It provides excellent hydration, alleviates irritations, accelerates wound healing, and possesses antimicrobial properties. It possesses anti-aging and skin-nourishing qualities. It aids in the regeneration, nourishment, and enhancement of the epidermis while functioning as an antioxidant. Amaranth oil protects hair from sun damage and effectively addresses greasy hair concerns, nourishes hair, and mitigates excessive hair loss due to its natural, abundant tocopherol content (Chao., 2021).

Taxonomy

The taxonomy of *Amaranthus dubius* plant is as follows:

- Kingdom : Plantae
- Phylum: Spermatophyta
- Class: Magnoliopsida
- Order: Caryophyllales
- Family: Amaranthaceae
- Genus: Amaranthus
- Species: *Amaranthus dubius*

Materials And Methods

Plant Collection

The plant sample was procured from the local market in Nagercoil. The collected leaves, stem, and flowers were thoroughly washed with distilled water to remove dust and other surface impurities, and then prepared for further experimental analysis.

Preparation of Plant Extract

The cleaned plant parts were cut into small pieces and transferred into a beaker containing 100ml of distilled water. The mixture was boiled for 20 minutes until the water absorbed a characteristic reddish coloration of *Amaranthus dubius*. The extract was then allowed to cool, filtered through Whatman No.1 filter paper to remove plant residues, and the filtrate was collected. The aqueous extract was stored at 4 °C in airtight containers until further use.

Phytochemical Screening

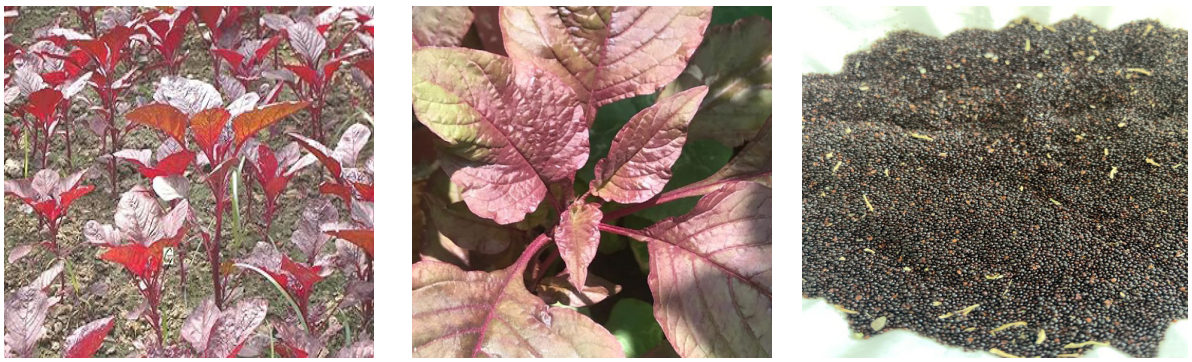
Phytochemical screening of the *Amaranthus dubius* extract was carried out to determine its qualitative chemical composition. Standardly employed precipitation and colorimetric reactions were used to detect the presence of major and secondary metabolites such as alkaloids, flavonoids, tannins, saponins, phenols, terpenoids, and glycosides etc.,

Test for Alkaloids

Mayer's test: Sample (2-3ml) was treated with few drops of Mayer's reagent. Appearance of white precipitate obtained.

Test for Flavonoids

Alkaline test: Neutral $Fecl_3$ is added to the extract, a black precipitate is obtained.



(a) (b) (c)

Figure 1: (a) Leaves of *Amaranthus dubius* (b) Plant of *Amaranthus dubius* (c) Seeds of *Amaranthus dubius*

Test for Amino Acids

Ninhydrin test: Test sample (3ml) and 3 drops of 5% ninhydrin solution were heated in boiling water for 10 minutes. Purple colour appeared.

Test for Steroids

To the test sample add $CHCl_3$ and con.H_2SO_4, the solution changes from purple to blue or green in colour.

Test for Terpenoids

To the test sample add 5 ml of $CHCl_3$ and 3 ml of con.H_2SO_4, a reddish-brown precipitate obtained.

Test for Phenol

The sample solution was treated with lead acetate solution to get a precipitate.

Test for Saponins

Foam test: To 1 ml of the extract 5 ml distilled water was added and shaken vigorously. A foamy lather obtained.

Tests for Glycosides (Br_2 water test)

On adding Br_2 water to the extract a pale-yellow colour appeared.

Anthocyanin (NaOH test)

To the test sample add 2 ml of NaOH solution, blue green colour appeared.

Test for Tannins

Add 5% $FeCl_3$, a black precipitate obtained.

Test for Reducing Sugar

Molisch's reagent is added to the extract, purple colour obtained.

Test for Xanthoproteins

To the extract add con. HNO_3 and NH_3, reddish orange colour obtained.

Quantitative Analysis of Basic Radicals

Test for lead

To the plant extract add KI, a yellow precipitate obtained.

Test for bismuth

To the plant extract add NH_4OH to excess, white or pale blue precipitate appears and dissolves to a deep blue solution.

Test for copper

Cupron reagent and NH_4OH were added to the plant extract, green colour appears.

Test for zinc

Add potassium ferrocyanide to the plant extract, white precipitate appears.

Test for cadmium

To the plant extract add dil. HCL, water and H_2S gas is passed. Yellow precipitate obtained.

Test for iron

Add potassium ferrocyanide to the leaf extract, Prussian blue colour appears.

Test for cobalt

To the plant extract add potassium thiocyanate, blue colour appears.

Test for aluminium

To the leaf extract add dil. HCL, aluminon reagent and ammonium carbonate is added. A bright red precipitate is obtained.

Test for manganese

Conc. HNO_3, sodium bismuthate and water were added to the leaf extract a pink colour appears.

Test for nickel

To the plant extract add dimethyl glyoxime and NH_4OH, a scarlet red precipitate obtained.

Test for barium

Acetic acid and sodium rhodizonate were added to the leaf extract, a brown spot is obtained.

Test for calcium

To the plant extract add NH_4OH and ammonium oxalate, a white precipitate is obtained.

Test for strontium

To the plant extract, add NH_4OH and sodium rhodizonate, a brown spot obtained.

Test for magnesium

Magneson reagent and NaOH were added to the leaf extract, blue precipitate is obtained.

Test for ammonium

To the test solution add NaOH and Nessler's reagent, reddish brown precipitate is obtained.

Results And Discussion

Phytochemical analysis

Preliminary phytochemical screening of Aqueous Extract of *Amaranthus Dubius*. The aqueous extract of *Amaranthus dubius* was screened for the presence of bioactive molecules using well-standard colorimetric and precipitation reactions. Qualitative analysis was showed the existence of glycosides, terpenoids, tanines, steroids, alkaloids, phenolic compounds, saponins and flavonoids. The related results are shown in Table 1.

Basic Radicals

The primary radicals in the aqueous extract of Amaranthus dubius are typically determined using quantitative chemical and mineral analysis of its phytochemical composition. The following primary radicals are present: calcium, potassium,

Table:1 Phytochemical screening of *Amaranthus dubius* plant extract

Phytochemicals	*Amaranthus dubius plant extract*
Anthocyanin	Absent
Glycosides	Pale yellow precipitate
Terpenoids	Reddish-brown precipitate
Phenols	Absent
Tannins	Black precipitate
Steroids	Green colour
Reducing sugars	Absent
Alkaloids	White precipitate
Phenolic compounds	Intense colour
Saponins	Foamy lather obtained
Flavonoids	black precipitate
Xanthoproteins	Absent

Table 2: Basic radical analysis of *Amaranthus dubius* plant extract

Basic radicals	*Amaranthus dubius* plant extract
Lead	Negative
Bismuth	Negative
Copper	Negative
Iron	Positive
Zinc	Negative
Cadmium	Negative
Cobalt	Negative
Magnesium	Positive
Aluminium	Negative
Manganese	Negative
Potassium	Positive
Sodium	Positive
Nickel	Negative
Calcium	Positive
Ammonium	Negative
Barium	Negative

sodium, magnesium, and iron. The mineral elements contribute to the nutritional value and biological activity of *Amaranthus dubius* (Table 2).

Conclusion

The current study confirmed that the aqueous extract of *Amaranthus dubius* contains a wide range of secondary metabolites, including glycosides, terpenoids, tannins, steroids, alkaloids, phenolic compounds, saponins, and flavonoids, all of which have well-known pharmacological and therapeutic properties. The fundamental radical analysis also confirmed the existence of key mineral elements including calcium, potassium, salt, magnesium, and iron, which help the plant's nutritional value and biological activity. These findings indicate that *Amaranthus dubius* is a possible source of natural bioactive chemicals and minerals, which lends credence to its historic use as both a medical plant and a nutritious vegetable.

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