

# Morphological, elemental and Antioxidant assay of *Sesamum radiatum* Schumach. & Thonn. leaves (Pedaliaceae R.Br)

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## ABSTRACT

*Sesamum radiatum* Schumach & Thonn., belonging to the family Pedaliaceae, is an erect annual herbaceous plant traditionally used in African and Asian medicinal systems. It has been employed in the treatment of inflammatory conditions, wounds, digestive disorders, and skin ailments, and is also recognized for its astringent and antioxidant properties. The present study was to evaluate the morphological features, elemental composition, and antioxidant potential of the leaves of *Sesamum radiatum* Schumach and Thonn. Morphological features are crucial for botanical identification and pharmacognostic standardization. Atomic Absorption Spectrophotometry revealed the presence of essential minerals like Iron (Fe), Zinc (Zn), Manganese (Mn), Nickel (Ni), Copper (Cu), and Chromium (Cr). Antioxidant activity, assessed by the 2,2-diphenyl-1-picrylhydrazyl assay, disclosed strong free radical scavenging potential. The results shows that *Sesamum radiatum* Schumach & Thonn leaves can be used in herbal and therapeutic applications.

**Key words:** *Sesamum radiatum*, Pedaliaceae, Atomic Absorption Spectroscopy, Antioxidant activity

## Introduction

In traditional medicinal practices, including those prevalent in various parts of India, including Kerala, sesame leaves have historically been utilized for their purported health benefits. Such traditional uses strongly suggest the presence of a diverse spectrum of bioactive compounds within the foliar parts of the plant. In the contemporary scientific landscape, there is a burgeoning interest in exploring underutilized plant resources as sustainable and accessible sources of essential nutrients. This aligns perfectly with the increasing global demand for natural antioxidants and mineral supplements, driven by a heightened awareness of their critical roles in human health and the prevention of chronic

diseases.

*Sesamum radiatum* Schumach. & Thonn, commonly known as African sesame or black sesame, is a wild species belonging to Pedaliaceae family. Indigenous to tropical Africa, this plant has garnered attention for its extensive ethnomedicinal applications and potential pharmacological properties. Traditionally, various parts of plants, including leaves, seeds, and roots, have been used in folk medicine. Modern science increasingly acknowledges the importance of phyto-chemicals and micronutrients present in leafy plant parts.

*Sesamum radiatum* Schumach. & Thonn. leaves have been found to contain phenolics, flavonoids, and tannins- bioactive compounds with significant antioxidant properties Zhou and Ibrahim (2010).

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These antioxidants play a crucial role in scavenging free radicals and preventing oxidative stress-related diseases such as cancer, cardiovascular disorders, and neurodegenerative conditions. Investigating the antioxidant profile of sesame leaves can therefore provide insight into their therapeutic potential and application in the formulation of herbal remedies and nutraceuticals. The studies on the plant *Pseuderanthemum crenulatum* (Wall.ex. Lindl) Radlk. revealed that it has feeble antioxidant activity (PPS and Sreelekshmi, 2024).

In addition to antioxidant analysis, the elemental composition of plant tissues provides essential information about their nutritional and pharmacological value. Atomic Absorption Spectroscopy (atomic absorption spectroscopy) is a reliable and sensitive method for the quantitative estimation of mineral elements such as iron (Fe), zinc (Zn), calcium (Ca), and magnesium (Mg). Previous studies have emphasized the elemental richness of medicinal plants and their potential health benefits. *Cyathula prostrata* (L.) Blume contains metals like copper, iron, calcium, chromium, nickel, sodium, cadmium, Lead, manganese, silver, magnesium and zinc (PPS and Shaniya mol, 2024). Elemental analysis of *Ipomoea* L. showed the presence of iron, manganese, chromium, nickel, lead, calcium, and zinc. (Preetha *et al.*, 2024). These nutritional benefits are coupled with a strong antioxidant capacity, which contributes to the plant's therapeutic effects.

Micro and macro elements influence biochemical processes in the human body. Studies of elements in indigenous medicinal plants disclose that both major and trace elements play substantial roles in combating various human diseases. The determination of heavy metals in medicinal plants can be achieved using a range of classical and advanced analytical techniques Dasgupta and Klein (2012). Morphological characteristics of plants are also fundamental in understanding plant taxonomy.

## Materials and Methods

### The study area

*Sesamum radiatum* Schumach. & Thonn leaves were collected from Kollam district of Kerala. The district lies between 8° 48' 0.00" north latitudes and between 76° 35' 60.00" east longitudes.

### Study method

The collected *Sesamum radiatum* Schumach & Thonn.

Specimens were identified with the help of Flora of Presidency of Madras (Gamble, 1924). Subsequently, the flower, leaf, and aerial sections of the plant were identified, and their morphological characteristics were noted and examined with a stereomicroscope.

Fresh leaves of *Sesamum radiatum* Schumach. & Thonn. was washed with running tap water. The clean plant material was then shade-dried and finely crushed into a powder using a mortar. Its elemental content was analysed through Atomic Absorption Spectroscopy (Model PinAAcle 900 Series AA spectrophotometer). For the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, the ascorbic acid was used as a reference standard. The stock solution was prepared in distilled water (1 mg/ ml; w/v). A 60 µM solution of 2, 2-diphenyl-1-picrylhydrazyl in methanol was freshly prepared, and 200 µl of this solution was mixed with 50 µl of the test sample at various concentrations. The plates were kept in the dark for 15 minutes at room temperature. The decrease in absorbance was measured at 515 nm.

Radical scavenging activity was calculated by the following formula: -

Percentage inhibition = (Absorbance of Control - Absorbance of test) × 10 ÷ Absorbance of control

## Results and Discussion

*Sesamum radiatum* Schumach. & Thonn. is an erect annual herb wild species, often with a reddish or purple-tinged, glandular-hairy stem. The plant surface is usually pubescent, particularly along the stems and leaf veins. Stems are solid or have a soft pith and shows angular ridges. Leaves are alternate or sub-opposite, ovate to lanceolate in shape, with coarsely toothed or lobed margins and a conspicuously hairy surface, especially beneath. Inflorescence is solitary and axillary, though sometimes forming short racemes. Calyx contains five narrow sepals, fused at the base, glandular-pubescent. Corolla is tubular and bilabiate, purple to violet in colour, larger than in *Sesamum indicum*, with a dense ring of hairs inside the throat below the stamens. Stamens are four (didynamous), inserted inside the corolla tube, with oblong, parallel anther cells. The ovary is superior, bicarpellary, with the development of false septa resulting in a 4-chambered capsule Style filiform, stigma bifid (2-lobed). Fruit is an oblong, hairy capsule, dehiscent loculicidally, 4-locular, and glandular hairy on the surface. Seeds are numerous, black to reddish-

**Table 1.** Antioxidant activity of methanolic extract of *Sesamum radiatum* Schumach. & Thonn

Concentration of sample ( $\mu\text{g/ml}$ )	Absorbance of Control	Absorbance of Sample	% of Inhibition
1.56	0.7952	0.805	4.85
3.12	0.7274	0.754	10.87
6.25	0.6812	0.716	15.41
12.5	0.5515	0.663	21.59
25	0.4587	0.605	28.49
50	0.1466	0.573	32.23
100	0.0926	0.515	39.13
200	0.0844	0.465	45.00
400	0.0650	0.354	58.16
800	0.041	0.314	62.88
1000	0.042	0.256	69.78

Please note that each result is an average of at least three independent measurements with a precision of about  $\pm 1\%$ .

brown, oblong to obovate, and more rugose or rough-textured

Elemental analysis was done to determine the metal composition in the plant *Sesamum radiatum* Schumach. & Thonn. In the present study, six different element concentrations present in the *Sesamum radiatum* Schumach. & Thonn were studied (Table 2), in which the elements such as Nickel, Manganese, Copper, Iron, Chromium, and Zinc. The amount of iron and zinc is more compared to other elements. The concentration of Iron (Fe) is 9.426 mg/L. Zinc (Zn) is 2.146, Manganese (Mn) is 2.079, Nickel (Ni) is 0.082, Copper (Cu) is 0.686, and Chromium (Cr) is 0.021.

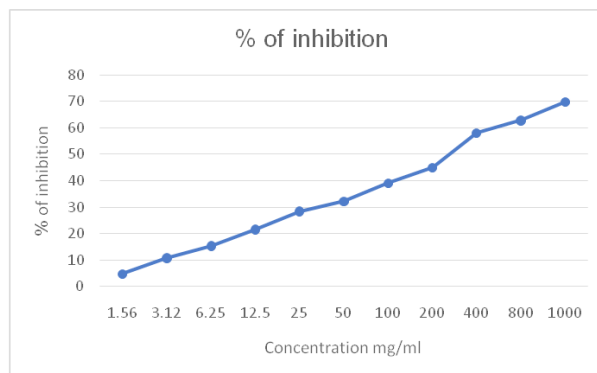
**Table 2.** Elemental analysis of *Sesamum radiatum* Schumach. & Thonn

Sl No.	Elements (Parameters) mg/l	
1	Fe (mg/l)	9.426
2	Zn (mg/l)	2.146
3	Mn (mg/l)	2.079
4	Ni (mg/l)	0.082
5	Cu (mg/l)	0.686
6	Cr (mg/l)	0.022

Antioxidants are molecules that prevent or reduce free radical reactions and delay or inhibit cellular damage. Antioxidants exist both enzymatic and non-enzymatic forms in the intracellular and extracellular environment, can be effectively used in the preventing free radical formation by scavenging them or promoting their decomposition (Sini *et al.*, 2010). Methanolic extract of the dried leaf powder used to determine the anti-oxidant activity. Ascorbic

acid is used as standard for estimating antioxidant activity. Absorbance was measured at 515nm by UV spectrophotometer. Lower absorbance of the reaction mixture indicated higher free radical activity. The existence and amounts of distinct components in various plants rely on the soil's composition, fertilizers and water used, as well as their acceptability plant selectivity and absorbability for the absorption of these elements by plants. The elemental uptake depends on the type of the plants and the environment.

The antioxidant potential of *Sesamum radiatum* Schumach. & Thonn leaves were evaluated using the 2,2-Diphenyl-1-picrylhydrazyl radical scavenging assay, a standard method for assessing free radical inhibition (Table 1). The leaf extracts exhibited significant dose-dependent scavenging activity, indicating the presence of strong antioxidant compounds. The high percentage of radical scavenging activity indicates the ability of *Sesamum radiatum*

**Fig. 1.** % of inhibition with different concentrations of plant extract of *Sesamum radiatum* Schumach. & Thonn

Schumach. & Thonn. to act as a natural antioxidant, potentially protecting biological systems from oxidative stress-induced damage (Figure 1). *Sesamum radiatum* Schumach & Thonn. could serve as a valuable source of natural antioxidants for pharmacological or nutraceutical development.

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### Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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