

The Journal of Phytopharmacology

(Pharmacognosy and phytomedicine Research)

Research Article

ISSN 2320-480X

JPHYTO 2019; 8(6): 295-298

November- December

Received: 23-09-2019

Accepted: 06-11-2019

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doi: 10.31254/phyto.2019.8605

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Phytochemical profile of different morphological organs of *Moringa oleifera* plant

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ABSTRACT

Moringa oleifera is an interesting plant containing different phytochemicals that determines its pharmacological and medicinal use. In this phytochemical profiling study, the presence of certain phytochemicals (tannin, phenol, flavonoid, saponin and alkaloid and volatile oil) were assessed at 1,2,3,4,5 % concentrations aqueous, ethanol, methanol and ethylacetate extract of the considered morphological parts (i.e. seed, flower, root and leaf) of *Moringa oleifera*. The result obtained shows that all the tested parameters are present in the leaf and root extracts of *Moringa oleifera* although their presence varies in different extract at different concentrations. However, volatile oil was found to be completely absent in flower and seed extracts of *Moringa oleifera*. Conclusively, the phytochemicals tested for in different morphological organs (seed, leaf, flower and root) of *Moringa oleifera* plant are present in varying degree in the various percentages of selected extraction solvents and this is suggestive of the medicinal potential of the plant.

Keywords: *Moringa oleifera*, Phytochemical profile, Morphological organs.

INTRODUCTION

Moringa oleifera is a fast growing, evergreen, deciduous tree of height 10–12m^[1]. The leaves are bipinnate or more commonly tripinnate, up to 45 cm long, and are alternate and spirally arranged on the twigs^[2]. *Moringa oleifera* flowers are fragrant and bisexual, surrounded by five unequal thinly veined yellowish-white petals^[1]. The vegetations are fragrant and bisexual, surrounded via 5 unequal thinly veined yellowish-white petals^[1]. *Moringa oleifera* however, is one of the 14 species of the moringaceae family, local to Africa, Arabia, India, Southeast Asia, southern America, the Pacific and Caribbean Islands^[3]. The other species includes *Moringa arborea*, *Moringa borziana*, *Moringa concanensis*, *Moringa drouhardii*, *Moringa hildebrandtii*, *Moringa longituba*, *Moringa ovalifolia*, *Moringa peregrine*, *Moringa pygmaea*, *Moringa rivaie*, *Moringa ruspoliana*, and *Moringa stenopetala*^[4,5]. In Nigeria, this plant is locally called “Okwe Oyibo”, “Zogale” and “Ewe Ile” in Igbo, Hausa and Yoruba languages respectively. The plant is otherwise known as “Nuggekai” in Canada, “Sonjna” in Marathi, “Murungai” in Tamil, “Mashinga Sanga” in Malayalan and “Muringa” in Konkani^[6]. *Moringa oleifera* is among the world’s most utilize trees, as almost every morphological parts of the tree can be used for different purposes^[7]. The versatility of this plant might not be unconnected to the presence of certain phytochemicals in different parts of the plant^[8]. Phytochemicals are non-nutritive plant chemicals that provide safety and prevention towards diseases. Several phytochemicals which include phenolic compounds, flavonoids, tannins, alkaloids, saponins, glucosides and numerous others have reportedly been isolated from this plant^[9]. This research therefore aims at confirming the presence of such phytochemicals (tannins, alkaloids, phenols, flavonoids, saponin and volatile oil) in various extracts obtained from different morphological organs (leaf, seed, root and flower) of the plant.

MATERIALS AND METHODS

Reagents

Acetone, Methanol, Ethanol, 2,2-diphenylpicrylhydrazyl (by Sigma Aldrich Chem. Co. Gmbtt Germany), Folin-ciocalteau, Hydrogen peroxide, Sodium hydroxide, Normal Saline, Acidified ferrous ammonium sulfate, 1,10-Phenanthroline, ThioBarbituric Acid (TBA), Glacial Acetic Acid (GAA), Heavy FeSO₄, Mercury chloride, potassium iodide, hydrochloric acid, Iron (III) chloride, Ethanol, Ethyl acetate, Methanol, sodium bicarbonate, aluminum chloride.

Plant

Moringa oleifera was collected in Aroje, Ogbomoso, Oyo state, Nigeria. The seed, flower, root and leaves of the plant were used as the main sample for phytochemical screening in the laboratory. 1gram each of the four morphological parts of *Moringa oleifera* (i.e seed, flower, root and leaf) were soaked in 20mls of distilled water, 1% volume per volume (v/v), 2% v/v, 3%v/v, 4%v/v ethylacetate, methanol and ethanol for 24 hours after which they were sieved to obtain aqueous, ethylacetate, methanol and ethanol extracts respectively. The filtrates were used as experimental samples.

Phytochemical profiling

Test for tannins and phenols

1ml of filtrate was added to 2drops of FeCl₃. Green precipitation indicates the presence of tannin and deep bluish green or dark green colour indicates the presence of Phenol ^[10].

Test for alkaloids

2 drops of Mayer’s Reagent and 2 drops of 2% v/v HCl were added to 1ml of filtrate. Cream or off white colour indicates the presence of Alkaloid ^[11].

Test for flavonoids

3 drops of 20% v/v of NH₃ added to 1ml of extract after which few drops of H₂SO₄ was added. Intense bright yellow coloration suggests the presence of flavonoids ^[12].

Test for saponin

1ml of distilled water was added to 1ml of the sample. Formation of foam after vigorous shaking for about 20minutes indicates the presence of saponin ^[13].

Test for volatile oil

In the test for volatile oil, 0.2mls of 1% w/v NaOH was added to 1ml of Sample. Formation of precipitate indicates presence of volatile oil ^[11].

RESULTS AND DISCUSSION

Table 1: Phytochemical screening of *Moringa oleifera* (Leaf)

Extracts	<i>Moringa oleifera</i> (Leaf)					
	Alkaloid	Volatile oil	Saponin	Phenol	Tannin	Flavonoid
Aqueous	-	+	-	-	-	-
1% Ethyl acetate	+	-	+	+	-	+
2% Ethyl acetate	+	+	+	+	-	-
3% Ethyl acetate	+	-	+	+	-	++
4% Ethyl acetate	-	+	+	+	-	++
5% Ethyl acetate	+	-	+	+	-	-
1% Ethanol	-	+	+	+	-	-
2% Ethanol	-	+	+	+	+	-
3% Ethanol	-	-	+	+	+	-
4% Ethanol	-	+	+	+	-	-
5% Ethanol	-	-	+	+	-	-
1% Methanol	-	-	+	+	+	-
2% Methanol	+	+	+	+	+	-
3% Methanol	+	+	+	+	+	-
4% Methanol	+	+	+	+	+	-
5% Methanol	+	-	+	+	+	-

Alkaloids is completely absent in distilled water and ethanol extracts of *Moringa oleifera* leaf but present in all chosen concentrations (1,2,3,4,5 % concentrations) of ethylacetate and methanol extracts except 4% concentration ethylacetate and 1% concentration methanol. Volatile oil was also confirmed to be present in all extracts of *Moringa oleifera* leaf although it was not found in certain concentrations. For example, it is absent in 1, 3, 5 % leaf ethylacetate extract and 3,5 % leaf ethanol extracts as well as 1,5 % leaf methanol extract. Saponin and phenol are found to be present in all extracts (except distilled water extract) of *Moringa oleifera* leaf at all tested concentrations. Tannin was found present in methanol extract at all concentrations and in ethanol extract at 2,3 % concentrations but completely absent in ethylacetate and aqueous extract of *Moringa oleifera* leaf. Flavonoids are only present in ethylacetate extract at 1,3,4% concentration of *Moringa oleifera* leaf. Its presence was found to be moderately high in 3,4 % concentration of leaf ethylacetate extract of the plant.

Table 2: Phytochemical screening of *Moringa oleifera* seed

Extracts	<i>Moringa oleifera</i> (Seed)					
	Alkaloid	Volatile oil	Saponin	Phenol	Tannin	Flavonoid
Aqueous	-	-	-	-	+	+
1% Ethyl acetate	+	-	-	-	+	++
2% Ethyl acetate	+	-	+	-	+	+++
3% Ethyl acetate	+	-	-	-	-	+
4% Ethyl acetate	+	-	+	-	-	++
5% Ethyl acetate	+	-	+	-	-	+
1% Ethanol	+	-	+	-	-	++
2% Ethanol	+	-	+	Trace	+	++
3% Ethanol	+	-	+	-	+	++
4% Ethanol	+	-	+	+	+	+
5% Ethanol	+	-	+	+	+	+
1% Methanol	+	-	-	+	+	++
2% Methanol	+	-	-	+	+	++
3% Methanol	+	-	+	+	+	++
4% Methanol	+	-	-	+	+	+
5% Methanol	+	-	+	+	+	+

Alkaloid is present at all chosen concentrations in all extract of *Moringa oleifera* seed except aqueous extract. On the other hand, volatile all is absent in all extracts of *Moringa* seed. Saponin is absent in aqueous extract of the plant seed but present in all other extracts of the seed. Its presence was confirmed at 2,4,5 % ethylacetate extract; 3 and 5% methanol extract and at all concentrations of ethanol extract. Phenol was absent in aqueous and ethylacetate extracts of *Moringa oleifera* but present at all concentrations of ethanol extract. Its presence was also confirmed in ethanol extract of *Moringa oleifera* seed at 2 (trace), 4, 5 % concentrations. Tannin was detected in aqueous extract and at all concentration of methanol and ethanol (except 1% concentration) extracts. Its presence was however confirmed only at 1 and 2 % concentrations of ethylacetate extract. Flavonoid is found present in all extract of *Moringa oleifera* seed at all concentrations although it is highly present at 2% concentration ethylacetate fraction and moderately present at 1,4 % concentration ethylacetate extract; 1,2,3 % concentrations of ethanol and methanol extracts.

Table 3: Phytochemical screening of *Moringa oleifera* root

Extracts	<i>Moringa oleifera</i> (Root)					
	Alkaloid	Volatile oil	Saponin	Phenol	Tannin	Flavonoid
Aqueous	-	-	-	-	-	-
1% Ethyl acetate	+	-	+	+	+	+
2% Ethyl acetate	+	-	+	+	+	+
3% Ethyl acetate	+	+	+	+	-	+
4% Ethyl acetate	+	+	+	+	-	+
5% Ethyl acetate	+	+	+	+	-	+
1% Ethanol	+	-	+	+	+	+
2% Ethanol	+	-	+	+	+	+
3% Ethanol	+	-	+	+	-	+
4% Ethanol	-	-	+	+	-	+
5% Ethanol	+	-	+	-	+	+
1% Methanol	-	+	+	+	+	-
2% Methanol	+	+	+	+	+	-
3% Methanol	+	+	+	+	-	-
4% Methanol	+	+	+	+	-	-
5% Methanol	-	+	+	+	-	-

The phytochemical profile of *Moringa oleifera* root revealed that alkaloid was absent in aqueous, 4% ethanol and 1, 5% methano extracts. Volatile oil is present in 3, 4 and 5% ethyl acetate extracts and at all concentrations of methanol extracts. Saponin and phenol was present in all the extracts but aqueous. Tannin was present in 1 and 2% ethyl acetate, 1, 2 and 5% ethanol extracts and 1 and 2% methanol extracts. Flavonoids were detected in ethylacetate and ethanol extracts at all concentrations.

Table 4: Phytochemical screening of *Moringa oleifera* flower

Extracts	<i>Moringa oleifera</i> (Flower)					
	Alkaloid	Volatile oil	Saponin	Phenol	Tannin	Flavonoid
Distilled water	-	-	+	+	-	+
1% Ethyl acetate	+	-	+	+	-	+
2% Ethyl acetate	+	-	+	+	-	++
3% Ethyl acetate	+	-	+	+	-	+
4% Ethyl acetate	+	-	+	+	-	++
5% Ethyl acetate	+	-	+	-	-	++
1% Ethanol	-	-	+	+	-	+
2% Ethanol	+	-	+	+	-	+
3% Ethanol	-	-	+	+	-	+
4% Ethanol	-	-	+	+	-	+
5% Ethanol	-	-	+	+	-	+
1% Methanol	-	-	+	+	+	-
2% Methanol	-	-	+	+	-	-
3% Methanol	-	-	+	+	-	+
4% Methanol	-	-	+	+	-	-
5% Methanol	-	-	+	+	-	+

-: Absent
 +: Present
 ++: Moderately present
 +++: Highly present

The phytochemical profile of *Moringa oleifera* flower shows that alkaloid was present in ethylacetate extracts at all concentrations and

2% ethanol extracts. While volatile oil was found to be completely absent in *Moringa oleifera* flower, tannin was detected only at 1% methanol extract. Saponin was detected in all the extracts at all concentrations while phenol was absent only at 5% ethyl acetate extracts. Flavonoids were present in aqueous, ethylacetate and ethanol extracts at all concentrations; moderately present in 2, 4 and 5% ethyl acetate extracts. It was also present in 3 and 5% methanol extracts of *Moringa oleifera* flower.

The “Moringa” tree is one of the most useful trees in the world [14]. The plant is highly valued since almost every part of the tree (leaves, roots, bark, fruit, flowers, immature pods and seeds) are useful [15, 16]. The plant is said to be high in phytochemical compounds as all parts of the plant have been reported to contain certain phytochemicals [17]. Phytochemical screening of a plant helps in the identification of the phytoconstituents of the plant [18]. The results obtained in this phytochemical profiling study show that tannin, phenol, saponin, alkaloids, flavonoids and volatile oils are present in *Moringa oleifera* tree. The result also reveals that all considered morphological parts of the plant (i.e seed, leaf, bark and root) are rich in phytochemicals of interest except volatile oil which is completely absent in the seed and flower of the plant at all tested concentration of the different extraction solvent used. Nevertheless, a variation in the presence of the tested phytochemicals was observed amidst the considered morphological parts and extraction solvent used.

CONCLUSION

Conclusively, tannin, phenol, flavonoid, saponin, alkaloids and volatile oil are present at varying degree in varying concentrations (1, 2, 3, 4, 5 %) of seed, leaf, flower and root of *Moringa oleifera*. Hence, the considered morphological parts of the plant are rich in phytochemicals and could thus be of therapeutic use.

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HOW TO CITE THIS ARTICLE

Ayoade ET, Akinyemi AO, Oyelere FS. Phytochemical profile of different morphological organs of *Moringa oleifera* plant. *J Phytopharmacol* 2019; 8(6):295-298.