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Original Research Paper

BOTANICAL AND PHYSICO-CHEMICAL STANDARDIZATION OF AERIAL PARTS OF *MURRAYA KOENIGII*

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ABSTRACT

Aim of the research work is focused on importance of medicinal plants to reveal their importance in the pharmaceuticals. Botanical and Physico-chemical Investigation of *Murraya koengii* was performed. plants has most the specific pharmacological activities such as stimulant, hypoglycaemic, antibacterial, antifungal, antiprotozoal, antioxidant, and hypolipidimic actions. Pharmacognostical standardization distinguished this plant drugs from others which is done by performing different methods such macroscopy, microscopy, and quantitative leaf microscopy of drug. The phytochemical screening of the plant revealed the presence of carbohydrate, starch, steroid, glycosides, Resins, Proteins and triterpenoid, Saponins, and flavonoids. This serves as an important tool for the quality assurance of plants for future studies. Through the Pharmacognostical Phytochemical (physiochemical) quality evaluation of crude drugs powder of *Murraya koengii* reveals that swelling index is very low value and foaming index is vary in limits that indicate the high presence of tannins. Amount of total ash is under the permitted limits. Which implies the presence of limited amount of minerals Among heavy metals cadmium was found under permitted limits but amount of arsenic, copper and lithium, was found very high which is not beneficial for the humans.

Keywords: *Murraya koengii*, Pharmacognostical standardization, Phytochemical, Antiprotozoal, Hypolipidimic, Fluorescence.

INTRODUCTION

Herbal drugs rely and based on the knowledge and experience of the medical practitioners for various indigenous systems of medicine. Thus According to our history, many infectious diseases has been treated with the help of herbal drugs. The traditional medicine therapy is increasing day by day through the traditional practitioners and herbalists in the treatment of infectious diseases. Among the remedies used, plant drugs constitute an important part. Current status on scientific investigations have highlighted the importance and the contribution of many plant families i.e. *Asteraceae, Liliaceae, Apocynaceae, Solanaceae, Caesalpinaceae, Rutaceae, Piperaceae, Sapotaceae, Campanulacae, Erytrhoxylacae, Nyssaceae, Acanthacae, Rubiaceae, Berberidaceaae, Graminae, Moraceae, Umbelliferae, Zingiberaceae, Leguminasae, Pinaceae, Cucurbitaceae, Styraceae, Convolvulaceae, polypodiaceae.*[1] Among all these families *Rutaceae* consists of various herbs, shrubs and trees with glandular punctuate, commonly possess smell and comprising about 150 genera and 1,500 species that are further characterized by the common occurrence of spines . Shrubs or trees are up to 4- 4.5 m tall and is found in evergreen areas and in moist environment.

Description of *Murraya Koenigii*[2]

Phytography

The plant is a spreading shrub or small tree (Figure 1 A&B). The main stem is dark green to

brownish, with numerous dots on it. The bark can be peeled off longitudinally, exposing the white wood underneath. The girth of the main stem is 16 cm. Leaves, (Figure 2A) exstipulate, bipinnately compound, 30 cm long, each bearing 24 leaflets, having reticulate venation; leaflets, lanceolate, 4.9 cm long, 1.8 cm broad, having 0.5-cm long petiole.[3] Fruits, round to oblong, 1.4 to 1.6 cm long, 1 to 1.2 cm in diameter (Figure 1 A); fully ripe fruits, black with a very shining surface. Seed, one in each fruit, 11 mm long, 8 mm in diameter, color spinach green. Flowers are bisexual, white, funnel-shaped, sweetly scented, stalked, complete, ebracteate, regular, actinomorphic, pentamerous, and hypogynous.[4] The average diameter of a fully opened flower is 1.12 cm. Inflorescence bears 60 to 90 flowers with calyx 5-lobed, persistent, inferior, green; corolla, white, polypetalous, inferior, with 5 petals, lanceolate, length, 5 mm; androecium, polyandrous, inferior, with 10 stamens, arranged into circles of five each; smaller stamens, 4 mm. long whereas the longer ones, 5 to 6 mm; gynoecium, 5 to 6 mm long; stigma, bright, sticky; style, short; ovary, superior (Figure 1B).[4]

Phenology

Flowering and Fruiting

Occurs between December to July.[5]

Distribution

Murraya koenigii (L.) is an aromatic more or less deciduous shrub or a small tree up to 6 m in height, found throughout India up to an altitude of 1,500 m 1655 m, It abundantly occurs along the outer Himalayas, Assam, Andaman Islands, Maharashtra, Tamil Nadu, Andhra Pradesh and in the forests of Western Ghats in Karnataka more commonly in forest often as gregarious under-growths. It is cultivated for its aromatic leaves in south East Asia and Australia, Upper and Lower Burma.[5]

Ecology and Cultivation

The plant grow best in tropical and sub-tropical climates in sunny to semi-shaded locations, though they can sustain in other climates by moving pots to warm protected areas in winter and maintaining humid conditions in areas where summers are hot and dry. They are very frost sensitive. Soil needs to be enriched with lots of organic material and be well drained. Seeds germinate readily.[6] Almost every part of this plant has a strong characteristic odor.

Folklore and Traditional Uses

The Bark and the Roots

Used as a stimulant by the physicians. They are also used externally to cure eruptions and the bites of poisonous animals.

Green Leaves

Green Leaves are stated to be eaten raw for curing dysentery, and the infusion of the washed leaves stops vomiting. Curry leaves are also used in calcium deficiency. It has Vitamin A, Vitamin B, Vitamin C, Vitamin B2, Calcium and iron in plenty. Its nutritional value benefits both the young and the old alike. Women who suffer from calcium deficiency, osteoporosis etc can find an ideal natural calcium supplement in curry leaves. Fresh juice of curry leaves, with lime juice and sugar, is an effective medicine in the treatment of morning sickness, nausea and Curry leaves can be used with effective result to treat burn, bruises and skin eruption. Cataract development can be prevented by using fresh juice of curry leaves. Kidney pain can be cured by using juice of root of *Murraya koenigii*. It can be used in preventing premature greying of hair.

Biological Potential of *Murraya koenigii*

Antibacterial activity[7], Antifungal activity[8], Antioxidant activity[9], Antiprotozoal activity[10], Hypoglycaemic activity[8], Haematological studies[11,] Anti-lipid peroxidative activity.[9]

MATERIALS AND METHODS

Collection and Identification of Plant Material

The plant material used in this study, aerial parts of *Murraya koenigii,* were collected from the herbal garden of School of Pharmaceutical Sciences, Shri Venkateshwara University, Gajraula, NH- 24, Rajabpur, Distt, Amroha (U. P), India. The plant material were identified and authenticated by taxonomically by Dr. R.S Saxena, Reader and Head of Botany Dept Meerut College, Meerut, (UP) India.

Processing of Plant Material

The plant materials were properly dried in shade for 5-6 days then dried in hot air oven at 40 ^{0}C after drying, the plant materials were milled to powder and passed through the sieve (mesh size 40), this material were used for the identification of plant metabolite.

Macro & Microscopic Identification

Thin section were made with the help of blade, stained and mounted following the usual plant micro-techniques. For the study of isolated cells and tissues, small pieces of leaves, roots, stem, were taken. Washed and mounted in glycerine. The anatomical sketches were made with digital camera.

Quantitative Leaf Microscopy

Quantitative leaf microscopy to determine palisade ratio, stomata number, stomata index, vein-islet number and veinlet termination number were carried out on epidermal strips.

Fluorescence Analysis

To check the fluorescent property of plants were powdered leaf material obtained which is used for to analysis under ultra and organic reagents like alcohol, 50% nitric acid and water. The florescence sulphuric acid, 10% sodium hydroxide, 50% behavior was noted as in table.

Solubility Behavior of Leaf Extracts of Plants with Different Solvents

Solubility of plant leaf extracts has been observed with different solvents.VIZ non polar, Polar, Polar acidic and polar basic.

Physico-Chemical Parameters for the Standardisation of Crude Drug

Determination of Foreign Matter

50 g of drug sample examined was weighed and spread out a thin layer. The foreign matter was detected by inspection with the unaided eye. Separated and weighed it and calculated the percent present. Drug undertaken for further study were free from moulds, insects, animal faecal matter and other contamination such as soil, stones and extraneous material.

Determination of Moisture Content (Hot Air Oven Method)

To determine the amount of moisture (water drying off from the drug) for substance appearing to contain water as the only volatile constituent, the procedure given below, was used. 2.78 g of drug (without preliminary drying) after accurately weighing was placed in a tare evaporating dish. After placing the above said amount of the drugs in the tared evaporating dish, dried at 105 ^{o}C for 5 hrs, and weighed, percentage was calculated with reference to initial weight.

Determination of ASH

Determination of Total Ash

About 2.0 g of powder drug was incinerated in a redtop silica dish at a temperature not exceeding 450 ^{o}C until free carbon was left, cooled and final weight was taken. The percentage of ash calculated with reference to the air-dried drug.

Determination of Acid Insoluble Ash

The ash obtained as above method was boiled for 5 minutes with 25 ml of dilute hydrochloric acid and collected the insoluble matter on the ash-less filter paper, washed with hot water and ignited to constant weight. The percentage of acid insoluble ash with reference to the air dried drug was calculated.

Determination of Water Soluble Ash

The ash was boiled for 5 minutes with 25 ml of water, collected insoluble matter on the ash-less filter paper, washed with hot water, and ignited for a temperature not exceeding 450 ^{0}C. The weight of the insoluble matter was subtracted from the weight of the drug ash. The difference in weight represents the water soluble ash. Finally percentage of water-soluble ash with reference to the air dried drug was calculated.

Determination of Extractable Matter

Method I (Hot Extraction)

About 25.0 g accurately weighed air-dried drug coarse powder was placed in thimble and refluxed with various organic solvents hexane, chloroform, ethyl acetate and alcohol. After recovery solvents under vacuum and drying in desiccators, the percentage extractable matter was calculated.

Method II (Cold Maceration)

About 2.0 g of coarsely powdered air dried material, was accurately weighed in a glass

stoppered conical flask and macerated with 100 ml of solvent for 6 hrs shaking frequently, then allowed to stand for 18 hrs, filtered rapidly taking care not to lose solvent. The extracted matter was dried at 105 ^{0}C for 6 hrs, cooled in desiccators for 30 minutes and then weighed. The percentage extractable matter was calculated.

Determination of Swelling Index

About 1.0 g fine powder accurately weighed was taken into 25 ml of glass stoppered measuring cylinder. The internal diameter of the cylinder was about 16 mm, the length of the graduate portion about 125 mm, marked in 0.2 ml in division from 0 to 25 ml in upward direction. 25 ml, of water was taken and the mixture thoroughly shaken every 10 minutes for 1 hrs. kept for 3 hrs at room temperature and the volume in ml occupied by the plant material, including any sticky mucilage was measured. The mean value of the individual determination, related to 1.0g of plant material was calculated.

Determination of Foaming Index

About 1.0 g a coarse powder of drug was placed into a 500 ml conical flask containing 100 ml of boiling water. The moderate boiling was maintained for 30 minutes. Cooled and filtered into a 100 ml volumetric flask and volume was made up to the mark with distill water.

The decoction was poured into 10 stoppered test-tubes (height 16 cm, diameter 16 mm) in successive portion of 1 ml, 2 ml, 3 ml, etc. Up to 10 ml, and adjusted the volume of the liquid in each tube with water to 10 ml. The tubes were stopper and shaken them in length wise motion for 15 seconds, two shake per second. After 15 minutes and height of the foam was measured. The results are assessed as follows.

- If the height of the foam in every tube is less than 1 cm, the foaming index is less than 100 &
- If the height of the foam 1 cm is measured in any tube, the volume of the plant material decoction in this tube (a) is used to determine the index. If this tube is the first or second tube in a series, prepare an intermediate dilution in a similar manner to obtain a more precise result.
- If the height of the foam is more than 1 cm in every tube, the foaming index is over 1000. In this case repeat the determination using a new series of dilution of the decoction in order to obtain a result.

Foaming index =1000\a

Where a = the volume in ml of the decoction used for preparing dilution in the tube where foaming to a height of 1cm is observed.

Determination of Heavy Metals

About 0.504 g air dried material was accurately weighed and placed in the test tubes for predigestion the test tube was contain 5ml nitric acid. It was kept as such for a day. Now digestion was perfomed by adding the nitric acid and perchloric acid in the ratio of 10:4 then 5 ml sample for determination was made as 3.57 nitric acid 1.42 perchloric acid. Now it kept for heating at 170-180 ^{0}C for about 4 hrs. Now sample was cool and filtered and volume was made up to 50 ml in volumetric flask with distilled water. With the help of instrument named as I.C.P. (O.E.S.) Model optima 5300 V, heavy metals was determined.

Determination of heavy metals:

Reading — Blank = y mg / L

Yx50/0.5 = Yx100 mg/kg (ppm). Where 0.5 is wt of drug taken.

Preliminary Screening of Phytochemicals

The preliminary phytochemical studies were performed for testing the different chemical groups present the drugs 10% (w/v) solution of extract was taken unless otherwise mentioned in the respective individual test. The chemical group tests were performed and the results are shown in tables. General screening of various extracts of the plant material was carried out for qualitative determination of the groups of organic compounds present in them; *Alkaliods, Crbohydrates, Flavonoids, Triterpenoids, Saponins*, *Steroids, Tannins, Starch*, *Proteins Cardiac Glycosides.*

RESULT AND DISCUSSION

Macroscopic Characters of Stem of *Murraya koenigii*

Stem

Murraya koenigii is an aromatic and small tree up to 6 m in height and 15-40 cm in diameter. The young stems are green in color with sweet aromatic odor and characteristic taste. The outer surface is smooth, soft and glabrous. The mature stems of *Murraya koenigii* are dark brown (unpeeled) and Cremish brown (peeled) in color with slight aromatic odor and characteristic taste. The outer surface is smooth and hard. The fracture of bark is splintery.

Leaf

Leaves are compound, imparipinnate, petiolate, exstipulate, rachis 11 to 20 cm long; leaflets 11 to 25, shortly petiolulate, arranged alternately on the rachis; lower pairs comparatively smaller in size, obliquely ovate, 2 to 5 cm in length and 1 to 2.5 cm in width, tip acute to obtuse, margin crenate-dentate, glabrous adaxially and pubescent abaxially with interspersed gland dots; main vein one and lateral veins 14 to 20 pairs; odour,; taste, acrid.

Microscopic Characters of Stem of *Murraya koenigii*

The stem of *Murraya koenigii* has a circular transaction and shows following features.

Epidermis

It is single layered, parenchymatous, uniseriate, unicellular, tangentially elongated surrounded by thick cuticle (Figure 3A). The diameter of epidermal cells is 7-8-15 µm. Epidermis exhibits 5-6 unicellular, uniseriate, covering trichomes. The length and width of trichome are 115-138-161 and 15-16-17 m, respectively.

Oil Gland

Just below the epidermis, there are 6-10 schizolysigenous oil glands (Figure 3A) present, having inner diameter of 46-76-115 µm and outer diameter of 61-94-130 µm.

Cortex

Continuous strands of 4-6 layers of compactly arranged parenchymatous, polygonal cells constitute the cortex region of 292-298-303 µm (Figure 3A). The diameter of individual cell is 19-35-49 µm. The cortex region shows the presence of lignified sclerenchymatic cells.

Vascular Bundle

The vascular system consists of a cylinder of xylem produced towards the inside and a cylinder of phloem outward along with bi or triseriate medullary rays. Vascular bundles are of collateral, conjoint and open type (Figure 3 A). The total region of xylem and phloem is of 73-97-119 and 38-64-95 µm, respectively. The distance between two medullary rays is 61-59-92 µm.

Pith

Pith consists of thin walled polygonal, parenchymatous cells bearing starch grains (Figure 3 A) of 6.89-13.69 µm. The total region of pith is of 38-64-95 µm.

At the secondary stage the primary cambium (in between the xylem and phloem) produces secondary vascular tissues and the xylem parenchyma soon becomes sclerenchymatous**.** For the better protection of the stem at the secondary stage, the cork-cambium originates in the outer side i.e., in the epidermis itself and produces cork cells on the outer side (total cork region is of 64-75-98 µm (and a layer of phelloderm (secondary cortex) on the inner side. At secondary stage medullary rays become fully developed i.e., penetrates inside the xylem region. Oil glands remain persistant during secondary growth, (A region of unmodified cells is also observed just below the xylem**)**

Microscopic Characters of Leaves of *Murraya koenigii*

Midrib

TS of leaf through midrib region flat towards adaxial surface and ridged towards abaxial surface; unicellular, non glandular trichomes arise from the abaxial epidermis; adaxial and abaxial hypodermis bi or tri seriate, composed of isodiametric collenchymatous cells; collenchymatous cells of both the surfaces possess single and twinned rhomboid calcium oxalate crystals, ground tissue composed of loosely arranged, thick-walled isodiametric

parenchymatous cells; vascular bundle forms an arc with adaxial xylem and abaxial phloem; xylem comprises of vessels with annular and spiral thickenings, xylem parenchyma and fibres; phloem contains sieve tubes, phloem parenchyma and phloem fibres (Figure 3 B).

Lamina

TS shows both the adaxial and abaxial epidermis covered by a cuticle; abaxial epidermal cells narrow and laterally elongated while those on adaxial surface slightly radially elongated; palisade biseriate, concentric starch grains of 3 to 5 µ diameter are found in spongy cells, spongy parenchyma made up of loosely arranged chlorenchyma; lysigenous cavities present; epidermal cells of lamina in surface view are elongated, straight walled and polygonal; in costal region they are elongated and thin walled; stomata more on abaxial surface than on adaxial; paracytic; stomatal index of abaxial epidermis 16 to18 and of adaxial epidermis 13 to 15; unicellular, non glandular, gradually tapering, curved trichomes measuring 80 to 160 µ long and 6 to 15 µ broad are distributed on the abaxial epidermal layers; trichomes numerous on costal region and fewer on intercostal regions, leaving cicatrices after detachment Figure 3B.

Physico-Chemical Standardization of *Murraya koenigii*

Physiochemical quality evaluation of crude herb powder was performed following the WHO procedures. The results are summarized in Tables below**.** It can be observed that plant have very low value of swelling index with moderate value of foaming index which implies towards the presence of tannins with little amount of mucilage, pectin or hemicelluloses. The value of total ash is not too much high due presence of amount of minerals (Na, K & Ca) is not too much higher. Among heavy metals cadmium content was under the permitted limit.

Qualitative Test for Phyto-Chemicals of *Murraya Koenigii*

Preliminary phytochemical screening was carried out by using standard procedure. The phytochemical screening of the plant revealed that there is no presence of resins & starch, whiles, protein steroid, glycosides, alkaloids saponins, carbohydrates are present. This serves as an important tool for the quality assurance of plant for future studies.

CONCLUSION

The present research shows the importance of plant in day to day life these phytochemicals obtained from the plant are very useful for treating different ailments and have a biological potential of to prove the usefulness to humans. The quantitative determination of pharmacognostic parameters will help for in the Standardization for crude drugs. The ash is particularly important in evaluating the purity of drugs. The pharmacognostic constants for the leaves of plant, is the diagnostic characters and the numerical standards reported in this work could be useful for the compilation of a suitable monograph for it proper identification. Hence, the determination of pharmacognostical and phytochemical profile of *Murraya koenigii* authenticates the Assessment of Quality of plant for further usage of this plant parts material to evaluate the safety and efficacy for mankin.

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Table 1: Botanical profile of *Murraya koengii*[2]

Botanical name	*Murraya koengii*
Synonyms	*Murraya koengii, Mitha neem, Curry patta*
Family	*Rutaceae*

Table 2: Vernacular names of *Murraya koengii*[2]

English	*Murraya koengii*
Sanskrit	*Krishna nimbi*
Hindi	*Kathnim, Mitha neem, Curry patta*
Gujarati	*Goranimb, Kadhilimbdo*
Bengali	*Barsanga, Kariphulli*
Assamese	*Narsinghs, Bisharhari*
Malayalam	*Karriveppilei*
Marathi	*Karhinimb, Poospala, Gandla,*
Telugu	*Karepaku*

Table 3: Taxonomy of *Murraya koengii*[2]

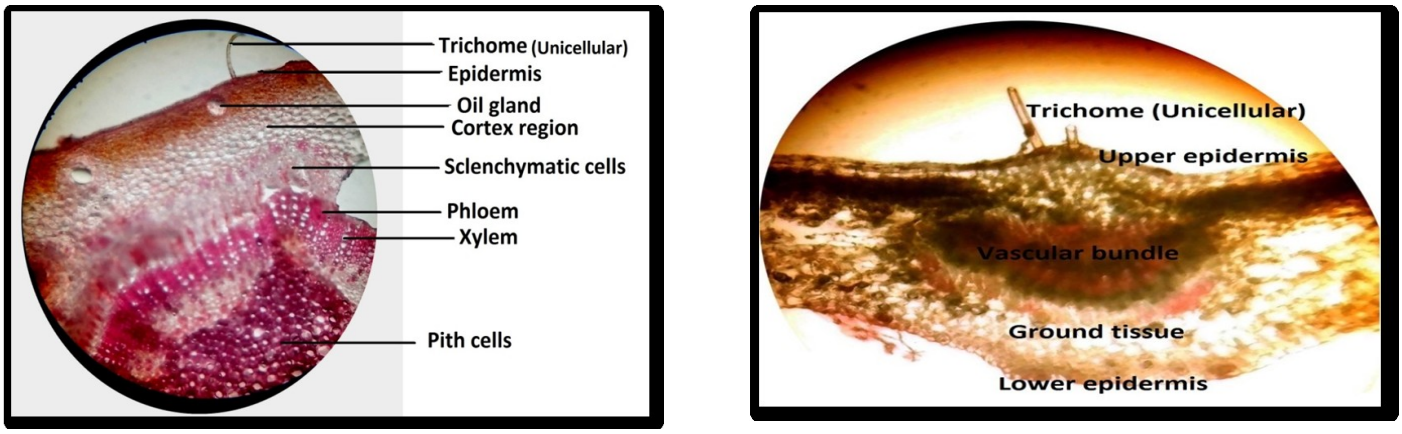
Kingdom	*Plantae*
Division	*Magnoliophyta*
Class	*Magnoliopsida*
Order	*Sapindales*
Family	*Rutaceae*
Genus	*Murraya*
Species	*koenigii*

A **B**

Figure 1: Photographs A and B whole plant of *Murraya koenigii* and flowers along with fruits

A: Leaves **B: Stem** **C: Root**

Figure 2: Photographs leaves stem and root of *Murraya koenigii*



A **B**

Figure 3: (A) Microscopy of stem of *Murraya koenigii*, (B) Microscopy of leaf of *Murraya koenigii*

Table 4: Quantative leaf microscopy of *Murraya koenigii*

Parameter	Range	Mean*
Palisade Ratio	11-14	12.85 ± 0.35
Stomatal Number Upper surface	0	0
Stomatal Number Lower surface	67-82	66.31 ± 6.81
Stomatal Index Upper surface	0	0
Stomatal Index Lower surface	13.47-15.42	14.68 ± 0.22
Vein islet number	12-15	13.64 ± 0.42
Veinlet Termination Number	9-12	13.62 ± 0.29

* Mean value of 10 counts

Table 5: Fluorescence behavior of leaves of *Murraya koenigii*

Treatment	Day light	UV light
Powder as such	Light Green	Fluorescent green
Powder in distilled water	Yellow-Green	Fluorescent yellow-Green
Powder in absolute alcohol	dark-green	Fluorescent green
Powder in 10% NaoH	Light brown	Fluorescent Dark brown
Powder in 50% HNO3	Yellow	Fluorescent Black
Powder in 50% H2So4	Green	Fluorescent Black

Table 6: Physico-chemical parameters of *Murraya koenigii*

Physico-chemical parameters of *Murraya koenigii*		
S. No.	Parameters	Observations
1.	**Botanical & Sensory characteristics**	
	Touch	Smooth
	Odour	Characteristically aromatic
	Taste	Acrid.
	Colour	Green
	Foreign Organic matter	No adulterants
	Microscopy	Detailed out under result and discussion section

2.	**Physicochemical**	
	Loss on drying(% w/w)	10. 19 ±0.15
	Ash Values (% w/w)	
	(a) Total Ash Value	11.33 ± 0.02
	(b) Acid Insoluble Ash	1.33 ± 0.02
	(c) Water Soluble Ash	1.01 ± 0.02
	Extractive Values (% w/w)	
	Cold percolation method	
	PE (40-60°)	10.60 ± 0.15
	MeOH (95%)	15.07 ± 0.05
	MeOH (50%)	12.09± 0.01
	H_2O	29.05 ± 0.15
	Soxhlet successive extraction method	
	Hexane	2.11
	$CHCl_3$	8.07 ± 0.05
	Ethyl acetate	11.12
	MeOH (95%)	21.05 ± 0.15
	Moisture content	3.03 ±0.01
	Volatile Oils(v/w)	0.83 %
3.	**Pharmacological**	
	Swelling Index	1.85 ± 0.15
	Foaming index	12.32
4.	**Heavy metals & Minerals (ppm)**	
	Cd	0.012±0.002
	Cr	2.243±0.023
	Cu	11.61± 0.62
	Pb	0.502±0.015
	As	6.621±0.324
	Hg	1.086±0.049
	Mn	39.85 ± 2.86
	Li	0.20±.07
	Ni	5.86±0.35
	Al	Traces
	Zn	18.32 ±1.32
	Mg	Traces
	K	0.34±0.02
	Na	0.88±0.03

Table 7: Qualitative analysis of plant metabolites (primary and secondary both) of aerial parts of *Murraya koenigii*

Phytochemical tests	*Murraya koenigii* leaf extracts			
Active constituents	MCR	MPE	MAC	MME
Alkalodids	+++	++	++	+
Flavonoids	++	++	+++	+
Saponins	_	+++	+++	++
Tannins	+++	+++	+++	++
Steroids	+++	+++	+++	+++
Cardiac Glycosides	+	++	++	+++
Proteins	++	+++	++	+
Resins	_	_	_	_
Starch	_	_	_	_
Triterpenoids	+	++	++	+
Carbohydrates	+++	++	+++	+

(-): No presence, (+): Less presence, (++): Moderate Presence,(+++): High presence, MCR: Crude powder, MPE: Petroleum ether extract, MAC: Acetone extract, MME: Methanol Extract, Common in MPE and MME. the Constituents can be further isolated and purified to find its potency for biological activities; (M= *Murraya koenigii*).

Table 8: Determination of *Murraya koenigii* leaf extracts with various solvents

Solvent	Solubility		
	MPE	MAC	MME
Non Polar			
Heptane	++	+	+
Pet Ether	++	+	+
Cyclohexane	++	+	++
Polar			
Ethanol	++	+++	+++
Methanol	+	+++	+++
Water (dist)	_	+	+
Polar Acidic			
Formic acid	++	+++	+++
Acetic acid	++	++	++
Chloroform	+++	++	++
Polar Basic			
Pyridine	_	++	+++
DMSO	++	+++	+++
DMFO	+	+++	+++

(-): No presence, (+): Less presence, (++): Moderate Presence,(+++): High presence, MCR: Crude powder, MPE: Petroleum ether extract, MAC: Acetone extract, MME: Methanol Extract

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