Comparative Pharmacognostical and Phytochemicalevaluationof Seedsof *Karanja (Pongamia pinnata*Pierre*)*and *Palasha*(*Butea monosperma*Lam).

Abstract:-

Background: *Karanja (Pongamia pinnata* Pierre*)* and *Palasha* (*Butea monosperma*Lam)are two important medicinal plants extensively described in *Ayurveda* for their *Krimighna*, *Kushtaghna*, *Kandughna*, and *Vranaropana* properties. Although both drugs are widely employed in traditional medicine, comparative pharmacognostical and physicochemical evaluation of their seeds, along with chromatographic profilingis limited. Standardization of these medicinal plants is therefore essential for ensuring their authenticity, quality, and therapeutic efficacy.**Aim:** The present study aimed to carry out a comparative pharmacognostical, physicochemical, phytochemical, chromatographic study of the seeds of *Karanja (Pongamia pinnata* Pierre*)* and *Palasha* (*Butea monosperma*Lam).**Materials and Methods:** Fresh seeds of *Karanja* and *Palasha* were collected, authenticated, and subjected to macroscopic and microscopic evaluation, powder microscopy, physicochemical analysis, preliminary phytochemical screening and thin-layer chromatography (TLC). Methanolic and petroleum ether extracts of *Karanja* and methanolic and chloroform extracts of *Palasha* were evaluated and compared using standard pharmacognostical and analytical procedures.**Results:** Comparative pharmacognostical studies revealed distinct diagnostic characters in both seed drugs, including differences in seed morphology, endosperm structure, sclerenchymatous cells, oil globules, stone cells, fibres, starch grains, and vascular elements. Physicochemical parameters complied with pharmacopoeial standards. Preliminary phytochemical screening confirmed the presence of flavonoids, fixed oils, phenolic compounds, tannins, and other secondary metabolites in both drugs. TLC profiles generated characteristic chromatographic patterns useful for identification and quality control. **Conclusion:** The present investigation established comprehensive pharmacognostical, physicochemical, phytochemical and chromatographicof *Karanja* and *Palasha* seeds. The diagnostic characters and analytical parameters generated in this study can serve as reliable standards for authentication, identification, and quality assessment of these medicinal plants.

Keywords:*Ayurveda*,*Karanja*, *Palasha*, Pharmacognosy, Phytochemical

Introduction

Ayurveda is gaining global importance due to its herbal formulations and drugs, which are valued for their effectiveness, easy availability, and fewer side effects. Seeds serve as reservoirs of diverse bioactive phytoconstituents.The phytochemicals contribute to the pharmacological effects such as antimicrobial, antifungal, antioxidant, anti-inflammatory, wound-healing, anthelmintic, and immunomodulatory activities. Although the seed-based formulas have been widely used in formulationsyet the Pharmacognostical standardization and scientific validation of the corresponding botanical resources is underrepresented.

In addition, substitution, misidentification and non-standardized methods of extraction represent enormous challenges in providing safety as well as efficacy of herbal formulations.To curb these issues, the present review is based on a comparative Pharmacognostical, phytochemical analysis with pharmacological evaluation of some selected seed plants in *Ayurveda* that people have been using in the management of health.

The selection of *Karanja* (*Pongamia pinnata* Pierre) and *Palasha* (*Butea monosperma* Lam.) for the present study is based on their classical Ayurvedic indications and documented *Krimighna* properties. In *Sushruta Samhita*, *Karanja* is mentioned in various contexts of *Sutrasthana*, where *Karanja Taila* is described as a *Krimighna* formulation useful in the management of disorders associated with microbial infestation [1]. Similarly, *Palasha* is documented in *Sushruta Samhita*, particularly in *Uttara Tantra*, where *Palasha Beeja Swarasa* has been indicated as a potent *KrimighnaDravya* [2]. In addition to their *Krimighna* action, authoritative *Nighantu* texts describe both *Karanja* and *Palasha* as *Twak Dosha Nashaka*, highlighting their therapeutic importance in dermatological disorders [3,4].The classical indications of seeds of *Karanja* (*Pongamia pinnata* Pierre) and *Palasha* (*Butea monosperma* Lam.) are depicted in Table 1 and Table 2

Table 1: Classical references on seed of *Karanja(Pongamia pinnata)* [5]

References	Indication	Classical usage
SS.U.54.25	Instrinsichaemorrhage	*Karanja* seed with honey and ghee warm salt and *Karanja* seed with curd water

VD 8.2-3	Abscess	Seed powder processed with *Snuhi* juice; oil extract.
VD.8.1	Abscess	Intake of *Karanja* seed, *Sunthi*&*Vacha* pounded with decoction of *Karanja*
GN.2.40.19	Eruptive Boils	*Karanja* seeds mixed with sesame & mustard
CS.Ci.7.93	Kushtha and worms	*Kushta* + *Karanja* seed+ *Chakaramarda* paste, *Vasa, Kutaja, Saptaparna, Karvira, Karanja, Nimba, Khadira* with cow urine, *Karanja* oil or mustard oil
SS.Ci.5.37	Vata covered with medas	*Karanja* seed paste with mustard + cow's urine
VM.61.90-91	Corneal opacity	*Karanja* seed powder impregnated with *Palasha* flower juice (collyrium)
SS.U.- Sushruta Samhita, Uttar Tantra, VD-Vadya Manorma,GN- Gadanigra,SS.Ci.- Sushruta Samhita, Chikitsa Sthan,VM- Vrindmadhav, CS.Ci- Charak Samhita Chitiksa Sthan		

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56 Table 2: Classical references ofseed of *Palasha(Butea monosperma)*[6]

References	Indication	Classical usage
CS.Ci.19.59-60; AH.Ci.9.68	Diarrhoea	Decoction of *Palasha* fruit (seeds) mixed with milk should be given followed by intake of warm milk according to strength.
SS.U.54.25	Worm Infestation	Decoction of palasa seed or paste of the same with rice-water should be taken.
VM.7.7	Worm Infestation	Decoction of palasa seeds mixed with honey or paste of the same with buttermilk should be taken. It destroys worms.
VD.3.16	Cough	*Palasha*seeds, *Udumbara* fruits and *Marica* taken together alleviatescough withing three days
BS.Netraroga 167	Corneal opacity	*Palasha* seeds impregnated with *phanijjaka* juice are dried and powdered. Its use as collyrium

		destroys corneal opacity.
AS.U.43.70	Scorpion sting	*Palasha* seeds impregnated with *Arka* latex should be made into apaste and applied locally. It removes pain.
RM.33.5	*Rasayana*	*Palasha* seeds and *Vidanga* mixed with juice of *Amalaki* fruits, honey and ghee should be taken for a month. It makes the old young.
GN.6.1.60	Contraceptive	*Palasha* seeds pounded finely and mixed with ghee and honey should be applied locally in vagina during season. It acts as contraceptive.
CS.Ci.- Charak Samhita Chikitsa Sthan, AH.Ci- Ashtang Hridya Chikitsa, SS.U.- Sushruta Samhita, Uttar Tantra, VM- Vrindmadhav,VD-Vadya Manorma, BS- Bangasena, AS. U-AshtangSangrehaUttartantra, RM- Rajamarttanda, GN-Gadanigra		

Table 3: Ayurvedic Energetics of seeds of *Karanja(Pongamia Pinnata)* and *Palasha (Butea monosperma)*[7,8]

Botanical Name	**Family**	***Rasa***	***Guna***	***Veerya***	***Vipaka***	***Doshakarma***
Pongamia pinnata	Fabaceae	*Tikta, Katu, Kashaya*	*Laghu, Tiksan*	*Ushna*	*Katu*	*Kapha -Vata Shamak*
Butea monosperma	Fabaceae	*Katu, Tikta, Kashaya*	*Laghu, Ruksha*	*Ushna*	*Katu*	*Vata-Kapha Shamak*

From a phytochemical perspective, *Karanja(Pongamia Pinnata)*seeds contain bioactive constituents such as karanjin and pongamol, while *Palasha*(*Butea monosperma)*seeds are reported to contain enzymes.

Through comparative approach, the assessment of morphological, anatomical, physicochemical and phytochemical properties of these seed extracts could be done in detail. It also focuses on the current processes of standardization that may assure reproducibility and quality assurance of herbal medicine. This review will use the textualknowledge as well as the contemporary scientific methods, to fill the knowledge gap between ayurvedic herbal practices and evidence-based pharmacotherapy.

Materials and methods

Seeds of *Karanja* and *Palasha*were collected from premises of Dayanand Ayurvedic College, Jalandhar at the time of its fruiting. Botanical identification was done with the help of various floras and it was authenticated at the institutional pharmacognosy laboratory.

Macroscopic evaluation

The seeds of *Karanja(Pongamia Pinnata)* and *Palasha*(*Butea monosperma)*were analyzed after making powder for the macroscopic study. Organoleptic features such as color, odor, taste, and texture of the powdered drugs were noted. Examination of the color was done under diffuse daylight. Surface characteristic, texture, and fracture characteristic were examined in samples. The material was touched to determine its softness or hardness. For odor determination, firstly the strength (none, weak distinct, and strong) and then the odor sensation (aromatic, fruity, musty, moldy, rancid, etc.) were assessed. Taste was perceived carefully by taking minute quantity of the powdered material. Table 5

Karanja (Pongamia Pinnata)

	
Figure 1- Whole plant	Figure 2 Seeds

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Palasha (Butea monosperma)	
	

Figure 3- Whole plant	Figure 4 - Seeds

Microscopic Evaluation

Powder microscopy

For powder microscopy, the test materials (seeds of *Karanja* and *Palasha*) were shade dried, and powders of seeds were passed through 60 no. mesh size and stored well separately in air-tight glass bottles. During drying process, 34°C average temperature and 50% humidity were noted. Total 5 days were taken for shade drying process of test materials. The drugs were individually spread on glass slides and observed under microscope at different magnifications and stained with different solution.[9]

Physicochemical analysis

Physicochemical analysis such as extractive values (water- and alcohol-soluble extractives), percentage of ash values, acid-insoluble ash, loss on drying (LOD) at 110°C, and pH of filtrate of 10% w/v aqueous solution (noted in Elico's digital pH meter using combined glass electrode) was carried out according to the official methods prescribed in Indian Pharmacopoeia.[10]

Preliminary phytochemical evaluation

Polar and non-polar extracts of seeds of *Karanja* and *Palasha* were subjected for the presence of bioactive compounds by using standard methods. [11]

Chromatographic analysis

Thin-layer chromatography is a technique in which a solute undergoes distribution between two phases, a stationary phase acting through adsorption and a mobile phase in the form of a liquid. The adsorbent is a relatively thin, uniform layer of dry finely powdered material applied to a glass, plastic or metal sheet or plate. Glass plates are most commonly used. Separation may also be achieved on the basis of partition or a combination of partition and adsorption, depending on the particular type of support, its preparation and its use with different solvent.[12]

Chromatography plates-

T.L.C. plate coated with 0.25 mm layer of silica gel GF 254 with fluorescent indicator,(Merck's) were used. Each plate was having dimension 10 cm long and 2 cm width.

Activation of pre-coated Silica gel G60F254

Plate was allowed to dry in hot oven at 105° C for one and half hour.

Preparation of mobile solution

Petroleum ether:methanol: (10:2) For *Karanja*

Toluene: Ethyl acetate: (9:1) For *Palasha*

Sample application

Sample was applied with the help of capillary 1(one) cm above the base of T.L.C.plate. Then it was dipped in mobile solution. T.L.C. plate was removed from the mobilesolution immediately after the spot reached the 1(one) cm below the top of the T.L.C.plate.

Visualization:

Under U.V. Long., Iodine Vapor and Direct Sunlight

Rf. Value-

Measure and record the distance of each spot from the point of its application and

calculate the Rf. value by dividing the distance travelled by the spots by the distance

travelled by the front of the mobile phase.

Calculation of RF Value

Distance travelled by solute from origin line

RF = ----------

Distance travelled by solvent from origin line

Observation and Results

Table 4: Macroscopiccharacters of seeds of *Karanja(Pongamia Pinnata)*and *Palasha (Butea monosperma)*

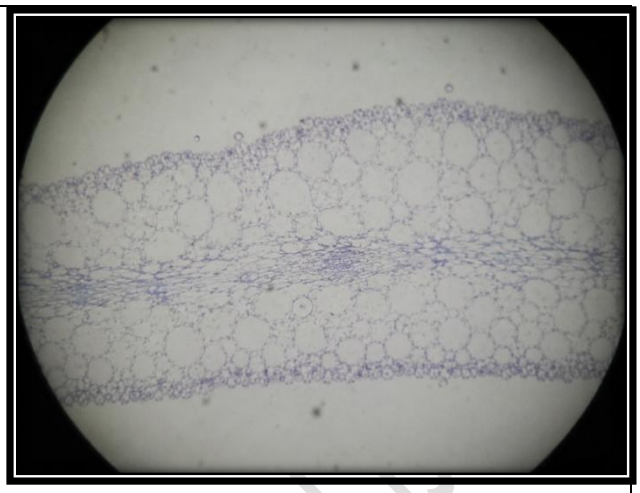
S.No.	Plant	Results
1.	*Karanja(Pongamia Pinnata)* Seed	Single seed within wrinkled with reddish leathery testa, micropylar end of cotyledons slightly depressed while other side semi-circular in shape
2.	*Palasha (Butea monosperma)* Seed	Flat, kidney-shaped to ellipsoid, measuring approximately 24–45 mm in length, 1–3 mm in width, and 1–2 mm in thickness; seed coat dark reddish-brown. The hilum is thin, glossy, and situated at the centre of the curved edge.

Organoleptic characteristics

Table 5: Organoleptic characters of seeds of *Karanja(Pongamia Pinnata)* and *Palasha (Butea monosperma)*

Organoleptic characters	Color	Touch	Odor	Taste
Karanja seed	Dark Brown	Smooth Oily	Characteristics	Pungent, Bitter
Palasha seed	Reddish brown	Smooth	Faint	Slightly acrid and Bitter

Microscopic characteristics

	
Figure 5	Figure 6
Transverse section of seed of *Karanja(Pongamia pinnata)*showing Endospermpolygonal cell.	Transverse section of seed of *Palasha (Butea monosperma)*showing outer epidermis, cortex, vascular strand, and inner epidermis.

Physicochemical analysis

Table 6: Physicochemical analysis of seed of*Karanja(Pongamia Pinnata)* and *Palasha (Butea monosperma)*

S. NO.	**PARAMETERS**	***KARANJA***	**API**	***PALASHA***	**API**
1.	Foreign Matter	Nil	Not More Than 1 percent	Nil	Not More Than 1 percent
2.	Loss on drying/ Moisture Content	4.17%	-	4.57%	-
3.	Total Ash %	2.70%	Not More Than 3 percent	7.16%	Not More Than 8 percent
4.	Acid Insoluble Ash %	Nil	Not More Than 3 percent	0.29%	Not More Than 0.5 percent

5.	Water Soluble Extractive value %	39.04%	Not Less Than 13 percent	85.76%	Not Less Than 25 percent
6.	Alcohol Soluble Extractive value %	47.2%	Not Less Than 23 percent	15.6%	Not Less Than 20 percent
7.	Fatty oil	-	-	24%	Not Less Than 6 percent
8.	pH Value	5.8	-	6.2	-

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148 **Phytochemical Screening**

149 Table 7: Presence (+) and absence (-) of active compounds in polarand non-polar extract of seed
150 of *Karanja(Pongamia Pinnata)*during phytochemical screening

S.NO	**Parameters**	**Methanolic Extract**	**Petroleum Ether**	**Test Performed**
1.	Carbohydrates	+ve	+ve	Fehling Test
2.	Alkaloids	-ve	+ve	Dragendroff's Test
3.	Flavonoids	+ve	-ve	Shindo Test
4.	Protein	+ve	+ve	Biuret Test
5.	Saponin Glycosides	-ve	+ve	Foam Test
6.	Tannins	+ve	-ve	$FeCl_3$ Test
7.	Steroids / Triterpenoids	-ve	+ve	Salkowski Test

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153 Table 8: Presence (+) and absence (-) of active compounds in polarand non-polar extract of seed
154 of *Palasha(Butea monosperma)*during phytochemical screening

S.NO	Parameters	Methanolic Extract	Chloroform Ether	Test Performed
1.	Carbohydrates	++	+	Molisch Test
2.	Alkaloids	++	+	Dragendorff's reagent
3.	Flavonoids	+++	+	Shinoda Test
4.	Protein	+	+	
5.	Cardiac Glycosides	+	+	Keller-Killani test
6.	Tannins	+	+	Ferric Chloride Test
7.	Steroids	+	+	Liebermann–Burchard Test

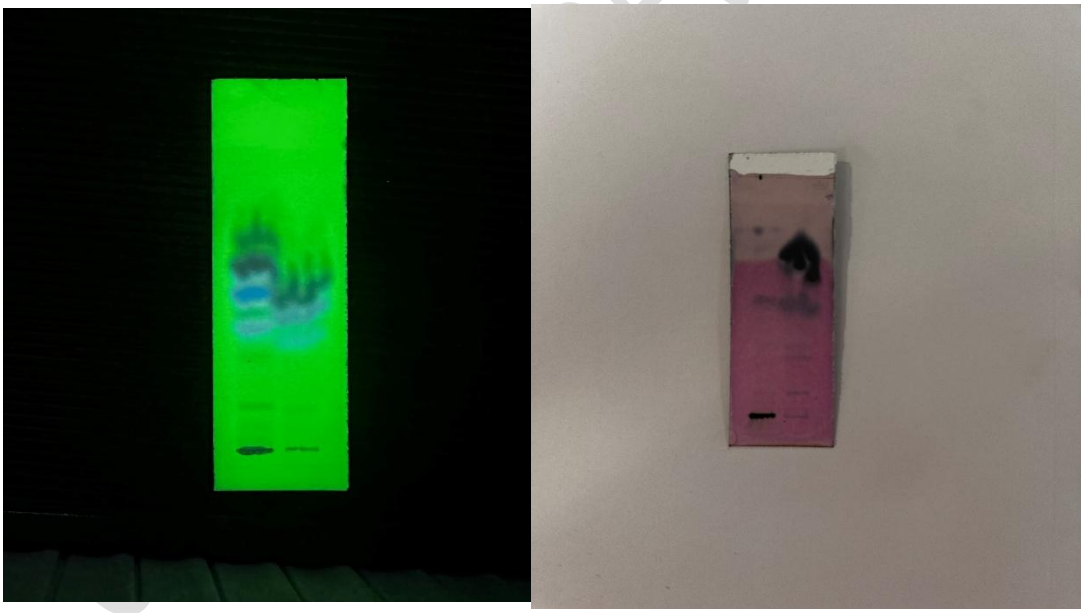

Figure 7: TLC*Karanja*at 254 nmFigure 8**:**TLC*Palasha*after derivatizing with Anisaldehyde-SulphuricAcid Reagent

Discussion

*Karanja(Pongamia Pinnata)*is an evergreen medium-sized glabrous tree with soft, greyish green bark. It reaches heights of 15 to 18 meters, with a short bole and a spreading crown. While *Palasha(Butea monosperma)* medium-sized deciduous tree that grows up to 12–15 meters in height. The bole is crooked and irregular. The bark is 5–6 mm thick and grey to greyish-brown in color, with red exudation. Branchlets are densely tomentose

Macroscopic characteristics

Macroscopy of seed of *Karanja(Pongamia Pinnata)*are usually single, and rarely two. They are elliptic or reniform in shape, measuring 1.7–2.0 cm in length and 1.2–1.8 cm in breadth. The surface is wrinkled with a reddish, leathery testa. The micropylar end of the cotyledons is slightly depressed, while the opposite side is semicircular.

Macroscopy of seed of *Palasha (Butea monosperma)* reddish-brown, thin, flat, reniform in shape. They are covered with a waxy seed coat and are obovate and compressed. They measure 3–4 cm in length and 2–2.5 cm in width. The raphe and antiraphe are equal, while the micropyle remains inconspicuous.

Organoleptic characteristics

Colour:

Karanja seeds are dark brown, whereas *Palasha* seeds are reddish-brown.

Touch:

Karanja seeds feel smooth and oily due to their high fixed oil content, while *Palasha* seeds are smooth but non-oily with a waxy texture.

Odor:

Karanja seeds possess a characteristic odor, while *Palasha* seeds have only a faint odor.

Taste:

Palasha seeds exhibit a slightly acrid and bitter taste. *Karanja* seeds also possess a bitter taste, which corresponds with their predominance of *Tikta*and*Kaṭu Rasa* described in the *Ayurvedic* classics.

Microscopic evaluation

Comparative microscopic evaluation demonstrated several diagnostic differences between the two seeds. *Karanja* seed is characterized by abundant brown pigment and numerous oil globules in the cotyledonary tissue, whereas *Palasha* seed is distinguished by the presence of Linea lucida, osteosclereids, balloon-shaped epidermal cells, and abundant starch grains and protein bodies

Powder microscopy

A comparative evaluation indicated that both seed powders possess characteristic testa fragments and storage tissues. *Karanja* seed powder is characterized by abundant sclereids, calcium oxalate crystals, lignified fibres, annular vessels, and palisade cells, whereas *Palasha* seed powder is distinguished by Malpighian cells, hourglass cells (osteosclereids), abundant spiral protein bodies, mucilage, oil globules, and comparatively fewer starch grains.

Physicochemical

Comparative physicochemical evaluation revealed that both *Karanja* and *Palasha* complied with the Pharmacopoeial standards for quality and purity. Both samples were free from foreign matter, indicating proper collection and processing.

The moisture content, as indicated by loss on drying, was slightly higher in *Palasha* (4.57%) than in *Karanja* (4.17%), although both values were sufficiently low to ensure good storage stability. Total ash and acid insoluble ash values were higher in *Palasha*, suggesting comparatively greater inorganic mineral content, whereas *Karanja* exhibited lower ash values, indicating comparatively fewer inorganic impurities.

The pH of *Karanja* (5.8) and *Palasha* (6.2) indicates that both drugs are slightly acidic in nature. *Palasha* is comparatively closer to neutral than Karanja. The slight difference in pH may be attributed to variations in their phytochemical composition and serves as a useful parameter for the standardization and quality evaluation of both drugs.

The extractive values demonstrated a clear difference in the chemical nature of the two drugs. *Palasha* exhibited a remarkably higher water-soluble extractive value, indicating the predominance of polar constituents. Conversely, *Karanja* showed a much higher alcohol-soluble extractive value, reflecting the abundance of moderately polar constituents such as fixed oils,

flavonoids, and related phytochemicals. These differences in extractive values correspond well with the known phytochemical composition of both medicinal seeds.

Preliminary phytochemical screening

In the present study, the methanolic extract of *Karanja(Pongamia Pinnata*) showed the presence of carbohydrates, flavonoids, proteins, and tannins, whereas alkaloids, saponin glycosides, and steroids/triterpenoids were absent. In contrast, the petroleum ether extract showed the presence of carbohydrates, alkaloids, proteins, saponin glycosides, and steroids/triterpenoids, while flavonoids and tannins were absent. This variation in phytochemical constituents is attributed to the difference in solvent polarity. Methanol, being a polar solvent, extracted polar compounds such as flavonoids and tannins, whereas petroleum ether, a non-polar solvent, preferentially extracted non-polar constituents such as steroids, triterpenoids, and fixed oils.

The methanolic extract of *Palasha(Butea monosperma)* revealed the presence of carbohydrates, alkaloids, flavonoids, phenolic acids, diterpenoids, proteins, cardiac glycosides, tannins, steroids, triterpenoids, and wax/oil. The chloroform extract also contained carbohydrates, alkaloids, flavonoids, diterpenoids, proteins, cardiac glycosides, tannins, steroids, triterpenoids, and wax/oil, while phenolic acids were absent. The higher intensity of flavonoids and wax/oil observed in the methanolic extract suggests that methanol was more efficient in extracting these phytoconstituents than chloroform.

Chromatographic Analysis

Thin-layer chromatography

Thin-layer chromatography of the seed extracts of*Karanja(Pongamia pinnata)* and *Palasha(Butea monosperma)* demonstrated distinct chromatographic fingerprints, reflecting differences in their phytochemical composition. *Karanja* seed extract developed in the solvent system Petroleum ether: Methanol (10:2, v/v)exhibited approximately five well-resolved bands under UV 254 nm, indicating the presence of multiple phytoconstituents of varying polarity

The TLC profile of *Palasha* (*Butea monosperma*) seed extracts developed in Toluene: Ethyl acetate (9:1, v/v) and visualized after derivatization with anisaldehyde-sulphuric acid reagent

exhibited distinct chromatographic fingerprints. The methanolic extract showed approximately four to five well-resolved bands, whereas the chloroform extract displayed two to three prominent bands, indicating differences in the polarity and distribution of phytoconstituents extracted by the two solvents.

Conclusion

Pharmacognostical study on seed of *Karanja(Pongamia Pinnata)* and *Palasha (Butea monosperma)*contributed certain pharmacognostical parameters that will be applicable for authentication and identification of the parts of drug. There is a need to focus on the preliminary throughput phytochemical screening of plants for their probable use in therapeutics. Fixed oil, saturated and unsaturated fatty acids, furanoflavonoids, flavonoids, and chalcones are the major phytoconstituents of *Karanja* (*Pongamia pinnata*) seeds, whereas fixed oil, fatty acids, glycosides, flavone glycosides, nitrogenous acidic compounds, palasonin, and unsaponifiable matter are the principal chemical constituents of *Palasha* (*Butea monosperma*) seeds. As no published evidences are developed on comparative pharmacognosy and preliminary physicochemical analysis of seed of *Karanja(Pongamia Pinnata)* and *Palasha (Butea monosperma)* plant, the results documented in the present study may be used as a standard in subsequent studies

Scope

Scopes are enlisted below as need for further research in view of its analytical and clinical study.

1. Comparative estimation of seed of *Karanja(Pongamia Pinnata)* and *Palasha* by HPLC method and its application to pharmacokinetic study may be done.

2. Comparative GC-MS analysis may be carried out for seed of *Karanja(Pongamia Pinnata)* and *Palasha*.

3. Clinical study of seed of *Karanja(Pongamia Pinnata)* and *Palasha*may be carried out in similar diseases where seeds are indicated clinically.

References

1. 1Dutt Shastri, K. D. A. Sushruta Samhita (2017), Sutrasthana chapter45 115Chaukhambha Bharati Sansthan, Page no.230
2. Dutt Shastri, K. D. A. Sushruta Samhita (2017), Uttartantra chapter 54/26 Chaukhambha Bharati Sansthan,Page no.512
3. Ray A, Aayilliath AK, Banerjee S, Chakrabarti A, Denning DW. Burden of serious fungal infections in India. Open Forum Infect Dis. 2022;9(12) ofac603. doi:10.1093/ofid/ofac603.
4. Dr.Inderdeva Tripathi, *Raj Nighantu, Dravyagunaprakashika*Hindi Commentatory, ChaukhambhaKrishandasAcademy,Varanasi,Reprint year 2016.
5. Sharma PV. Classical uses of medicinal plants. Varanasi: ChaukhambhaVisvabharati; 1996. p.81
6. Sharma PV. Classical uses of medicinal plants. Varanasi: ChaukhambhaVisvabharati; 1996. p. 233
7. PadmaShree Proff.Krishna Chandra Chunekar, Dr. Ganga Sahay Pandey, *Bhavprakash Nighantu*-Indian Media Medica, Guduchyadi Varga, Chaukhambha Bharat Academy, Varanasi,Page no.334
8. PadmaShree Proff.Krishna Chandra Chunekar, Dr. Ganga Sahay Pandey, *Bhavprakash Nighantu*-Indian Media Medica, Guduchyadi Varga, Chaukhambha Bharat Academy, Varanasi,Page no.525
9. Wallis TE. Text Book of Pharmacognosy. 5th ed. New Delhi: CBS Publishers & Distributors; 2002. p. 571-8.
10. Anonymous. Indian Pharmacopoeia. Vol. 2. Delhi: Government of India, Publication the Controller of Publication; 1996. p. A53-4.
11. Khandelwal KR. Practical Pharmacognosy Techniques and Experiments. 9th ed. Pune: Nirali Prakashan; 2008. p. 149-56. 17.
12. Anonymous. Indian Pharmacopoeia. Vol. 2. Delhi: Government of India, Publication the Controller of Publication; 1996.

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