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A COMPARATIVE PHARMACOGNOSTICAL & PHYTOCHEMICAL STUDY ON DIFFERENT PLANT SOURCES OF PARPATAK

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ABSTRACT

Being a controversial herb as per different ayurvedic literatures *Parpat* or *Parpatak* deserves due clarification for the sake of its true identification & authentication. Literature survey shows more than 10 different plants are being used, substituted or adulterated as *Parpatak*. Previously *Fumaria parviflora* Lamk. was vastly accepted as *Parpatak* in different books & same species was also accepted in A.P.I accordingly. In present research work emphasis has been mainly put on the selected plants to have a ray of light through comparative studies of four source plants to propose a more satisfying & reasonable conclusion on the controversy over *Parpatak*. The research work was carried out as per standard operating procedures & in accordance with specified protocols. Pharmacognostical & phytochemical studies were carried out in respective laboratory of IPGT & RA, Gujarat Ayurved University. Various synonyms of *Parpatak* were discussed thoroughly. Then these synonyms were tried to match with different characters of all four plants. *Fumaria indica* (Hausk) Pugsley was found to match most of the synonyms satisfactorily. The Pharmacognostical study showed presence of rosette crystals in *Oldenlandia corymbosa* Linn & *Mollugo oppositifolia* Linn, but were absent in *Scoparia dulcis* Linn & *Fumaria indica* (Hausk) Pugsley. Preliminary phytochemical screening revealed presence of Phenolic compound in all the 4 selected plants. The modern research trend also showed that *Fumaria indica* (Hausk) Pugsley is having pharmacological activity (literature survey) similar to that of *Parpatak*.

With all these data generated in this research work, it may be concluded that *Fumaria indica* (Hausk) Pugsley is the most suitable candidate to be proposed as the authentic plant source of *Parpatak.*

KEY WORDS: *Parpatak*, Comparative, Pharmacognosy, Phytochemical.

INTRODUCTION

Parpatak as an Ayurvedic drug had been mentioned in Ancient-period (*Prachina kala*) by a great Grammarian Panini in his treaty "*Paniniya Unadi Bhogvritti.*" [1] After the Vedic period was over, *Parpatak* had almost been mentioned in every Ayurvedic literature or lexicon, as for instance like in *Caraka Samhita*,[2] *Sushrut Samhita*,[3] *Astanga Hridaya*[4] etc. In this research work 4 probable source plants of *Parpatak* were selected through literature review for the comparative study. The first drug consists of dried as well as whole fresh plant of *Oldenlandia corymbosa* Linn. belonging to the family Rubiaceae, vernacular name is *Kshetparpat* (Bengal).[5] Decoction of the whole plant used in liver complaints and as an alternative in low forms of fever i.e. remittent fever with gastric irritability.[6] The second drug consists of whole plant of *Scoparia dulcis* Linn. belonging to the family Scrophulariaceae, vernacular name is *Santal-jastimadhu*.[7] An infusion of leaves is used in fever, cough and bronchitis and as gargle for toothache, decoction of the leaves and root are useful in fever. The third drug consists of dried as well as whole fresh plant of *Mollugo oppositifolia* Linn. belonging to the family Molluginaceae & vernacular name is *Pitasag*.[8] Drug is given as infusion to promote digestion also to promote menses & suppressed lochia.[9] The fourth plant consists of fresh & dried whole plant of *Fumaria indica* (Haussk.) Pugsley belonging to the family Fumariaceae, vernacular names are *Parpat*, *Varatikta*, *Suksmapatra*, *Renu*, *Parpataka*, *Shahtaraj*, *Vanshulpha*, *Bansulpha*, Fine leaved fumitory, *Pitpapda*, *khadsalio*, *Dhamgajra*, *Shahterah* etc.[10,11,12] The plant is bitter, slightly acrid, astringent, hepato-protective,[13] anthelmintic,[14] anti-inflammatory,[15] analgesic[16] & having antipyretic [17] activity.

Substitutes of *Fumaria indica* Pugsley

Different substitutes of *Fumaria indica* Pugsley which are used in various part of the country are given in table number 1. [18, 19, 20]

MATERIALS & METHODS

Macroscopic evaluation

The samples were cleaned and macroscopic evaluation of whole plant was carried out. The leaf, stem and root were then separated and individual macroscopic characters like size, shape, texture were noted in detail. [21, 22]

Microscopic evaluation

Free hand transverse sections of leaves, stems and roots were taken and cleared with chloral hydrate solution. Sections were first observed in distilled water then stained with phloroglucinol and conc. HCl. Microphotographs were taken by Carl-zeiss-trinocular microscope. [23]

Organoleptic evaluation

Organoleptic characters like color, odor, taste, snap of fracture and feel of drug to touch were performed as per standard procedure. [24]

Powder Microscopy

For microscopic evaluation of the powder, small quantity of each powder was studied under the microscope, first with distilled water to observe crystal system and then stained with iodine solution for starch grains. Another set of slides were stained with phloroglucinol & concentrated HCl for lignified tissues, Microphotographs were taken by Carl zeiss trinocular microscope. [25]

Histo-chemical evaluation

To detect the location site of various constituents of the drug, sections of leaf, stem and root were treated with various reagents like ruthenium red (for mucilage), $FeCl_3$ solution (for tannin), iodine for (starch grains) etc. [26]

Physico-chemical parameters of the study drugs

Physico-chemical parameters like foreign matter, Moisture Content (Loss on Drying), P^H, Total Ash, Acid Insoluble Ash, Water Soluble Extractive, Alcohol Soluble Extractive values of all four samples were determined as per standard protocols.[27]

Preliminary Phytochemical Screening

Qualitative tests were performed by using appropriate extract. Tests for Alkaloids, test for Flavanoid, tests for Terpenoid, test for Protein, tests for Phenolic compound (Tannins), tests

for Carbohydrate, test for Cardiac glycoside, test for Anthraquinone glycoside, test for saponin glycoside, test for coumarine glycoside were performed according to standard procedure. [28]

Thin-Layer Chromatography (TLC)

Thin-layer Chromatography of alcohol soluble extractives was performed as per standard chromatographic procedure to obtain the R_f value. [29, 30]

HPTLC (High Performance Thin Layer Chromatography)

HPTLC of alcohol soluble extractives was performed as per standard chromatographic procedure. [29, 30]

RESULTS

Comparative Pharmacognostical Studies

Macroscopic studies: Results of comparative study regarding different parts of the all four plants with their macroscopic characters have been given in table no. 2 (Fig. 1- 4).

Microscopic studies: Results of comparative study regarding leaf, stem, root of the four plants with their transverse microscopic sections have been given in table no. 3 (Fig. 5 - 28).

Organoleptic evaluation: Results of comparative study regarding powder of the four plants with their organoleptic evaluation have been given in table no. 4.

Powder character: Results of comparative study regarding powder of the four plants with their microscopic characters have been given in table no. 5 (Fig. 29 - 36).

Comparative Studies on Physicochemical Parameters

Results of comparative study regarding P^H, L.O.D, A.V. etc. of the four plants with their physicochemical parameters have been given in table no.6.

Comparative Studies on Secondary Plant Metabolites

Test results of comparative study regarding the four plants with their secondary plant metabolites have been given in table no.7

Comparative Studies on T.L.C & H.P.T.L.C Profile

T.L.C. profile was generated in present research work by following the method as described in A.P.I (Ayurvedic Pharmacopoeia of India).[31] $CHCl_3$: MeOH = 8:2 were used as solvent

system & plate prepared with silica gel G were used as stationary phase. A.P.I had mentioned eight fluorescent zones under 366 nm. In present work, 6 fluorescent zones were detected under 366 nm u.v light (table no. 8) & two sets of R_f value were given in the respective table.

T.L.C profile: R_f values found under 366 nm u.v light have been given in the table no.8 (Fig. 37 - 40).

HPTLC profile: Using same (as in TLC) solvent system H.P.T.L.C. data were also generated & detail of R_f values have been represented in the Table no. 9 & 10 respectively; comparative data revealed that R_f value at 0.50 was identical in both the cases of present research work & that of R_f mentioned in A.P.I., Another two R_f values at 0 .66 & 0.78 were found to be close to match with R_f value at 0.67 & 0.79 as mentioned in A.P.I. (plate no. 7). Results of HPTLC Plate observed under u.v.(254 nm) light, using the solvent system $CHCl_3$:MeOH = 8:2, have been given in table no.9 (plate no. 8).

Results of HPTLC Plate observed under u.v. (366 nm) light, using the solvent system $CHCl_3$:MeOH= 8:2, given in the table no. 10 (plate no. 9)

Results of HPTLC Plate observed under the visible light, after spraying with Dragendorff's & Methanolic sulphuric acid reagent, using the solvent system $CHCl_3$:MeOH= 8:2, given in the table no. 11 (plate no. 7).

TABLES

Table no. 1: Different substitutes of *Parpatak*

Botanical name	**Region where used**
Oldenlandia corymbosa Linn.	Bengal, Maharashtra
Polycarpea corymbosa Lam.	Uttar Pradesh
Justicia procumbens Linn.	Maharashtra, Gujarat
Rungia repens Ness.	Gujarat
Peristrophe bicalyculata Ness.	Southern India
Glossocardia linearifolia Cass.	Pune & Central-India
Mollugo oppositifolia Linn.	Southern India
Fumaria officinalis Linn.	Common fumitory of Persia
Fumaria parviflora Lamk.	Common fumitory of Europe
Scoparia dulcis Linn.	Bengal, Tamilnadu

Table no. 2: Comparative study of macroscopic characters

Character	*O. corymbosa*	*S. dulcis*	*M.oppositifolia*	*F. indica*
Leaf	Acute, linear	Lanceolate	Obovate	Multifid, Acute, linear
Stem	Slender, smooth	Tough, glabrous	Prostate, sub-glabrous	Erect, glabrous
Fruit	Capsule broad	Globose	Ellipsoid	Globose
Flower	Dull white	White	Greenish white	Light pink

Table no. 3: Comparative study of microscopic characters

P.u.o	*O. corymbosa*	*S. dulcis*	*M.oppositifolia*	*F. indica*
t.s.t.m.	Dorsi ventral	Dorsi ventral	Dorsi ventral	Dorsi ventral
u.e.	1 layered	1 layered, m.g.t	1 layered, m.g.t	1 layered
l.e.	1 layered	1 layered	1 layered	1 layered
Stomata	Paracytic	Anisocytic & diacytic	Diacytic	Anomocytic
u.p	2 layered, rosette & acicular crystals	2 layered, acicular & cigar shaped crystals	2 layered, rosette crystals, oil globule	1 layered, aggregate crystals.
m.l	3-5 layered	3-5 layered	3-4 layer	2-4 layered
t.s.s	Joined kidney shaped outline	hexagonal in outline	circular shape in outline	Pentagonal in Outline
epi.	1 layered	1 layered	1 layered	1 layered
Cortex	5-8 layered, outer 1-2 layer colleen-chymatous inner parenchyma cells are loaded with rosette, prismatic crystals of calcium oxalate, tannin, oil globules	3-5 layered. Extension part of epidermis is made of 3-5 layers of chollenchyma-tous cells. Inner cells loaded with prismatic crystals of calcium oxalate, oil globules.	5-6 layered, Inner parenchyma cells loaded with rosette, prismatic crystals of calcium oxalate, tannin, oil globules.	3-6 layered, Inner parenchyma cells loaded with prismatic crystals of calcium oxalate & tannin content.
v.b	Open, collateral	Open, collateral	Open, collateral	open, collateral
Pith	Pith cells were filled with oil globules and some rosette crystals of calcium oxalate	Pith cells were filled with oil globules, simple and compound starch grains and sphenoid crystals of calcium oxalate	Pith cells filled with oil globules & with some simple starch grains.	Pith are filled with some prismatic crystals

t.s.r	Circular outline	Wavy & Circular outline	Circular outline, 2nddary growth	Circular outline, 2nddary growth
Cork	3-5 layered	3-5 layred	3-4 layered	2-4 layered
Cortex	3-6 layered	5-6 layered	4-6 layered	4-6 layered
v.b	Open,collateral	Open,collateral	Open,collateral	open, collateral
m.r	Bi-serrate to multiserrate	Bi-serrate to multiserrate	Bi-serrate to multiserrate	Bi-serrate to multiserrate

P.u.o = parts under observation; t.s.t.m. = transverse section through midrib; u.e. = upper epidermis; l.e. = lower epidermis; u.p = upper palisade; m.l = mesophyll layer; t.s.s = transverse section of stem; e.p.i = epidermis; v.b = vascular bundle; t.s.r = transverse section of root; m.r = medullary rays.

Table no.4: Comparative study of organoleptic evaluation

O. C	***O. corymbosa***	***S. dulcis***	***M.oppositifolia***	***F. indica***
Colour	Dark green	Yellowish green	Yellowish green	Dark green
Odour	Characteristic	Characteristic	Slightly offensive	Sweet
Taste	Light astringent	Slightly bitter followed by light astringent	Slightly bitter	Bitter
Touch	Rough	Rough	Rough	Rough

o. c = organoleptic character

Table no. 5: Comparative study of powder characters

Characters	***O.corymbosa***	***S. dulcis***	***M.oppositifolia***	***F. indica***
Pollen grain	++	++	++	++
Pitted vessels	-	+	-	+
Fibre	-	+	-	+
Cork cells	+	-	-	+
Prismatic crystal	+++	-	++	++
Annular vessel	-	-	+	+
Tannin content	++	+	+	+++
Starch grains	-	++	+++	+++
A. stomata	-	-	+	-
Spiral vessel	+	+	+	-
Stone cell	-	-	+	-
G. trichome	-	+	-	-
Acicular crystal	++	-	-	-
Rosette crystal	+	-	+	-

stomata = anomocytic stomata; G. trichome = Glandular trichome;

sign : + = present; ++ = moderately present; +++ = abundantly present; - = absent

Table no.6: Comparative study of physicochemical parameters

Parameter	*O.corymbosa*	*S. dulcis*	*M.oppositifolia*	*F. indica*
P^H Value	6.0	5.5	8.5	6.5
L.O.D	12.306 %	8.909 %	9.680 %	12.036 %
A.V.	10.592 %	8.793 %	22.706 %	24.962 %
A.I.A.	2.158 %	2.548 %	5.156%	5.530 %
W.E.	16.467 %	12.195 %	30.524 %	29.571%
A.E.	8.950 %	8.724 %	7.724 %	17.661 %

L.O.D = Loss on drying, A.V = Ash value, A.I.A = Acid insoluble ash, W.E = Water soluble extractive value, A.E = Alcohol soluble extractive value;

Table no.7: Comparative study of secondary metabolite

Secondaey metabolites	*O.corymbosa*	*S.dulcis*	*M.oppositifolia*	*F. indica*
Alkaloids	-	+	+++	++
Phenolic compound(tannin)	++	+	+	++
Coumarin glycoside	-	+	+	+++
Flavonoids	+	+	+	+
Saponin glycoside	-	-	+	+
Cardiac glycoside	+++	++	+	-
Terpenoids	+	+	+	+
Carbohydrate	+	+	+	+
Anthraquinone glycoside	-	-	-	-

sign: + = present; ++ = moderately present; +++ = abundantly present; - = absent

Table no.8: R_f value at 366 nm (T.L.C)

R_f mentioned in A.P.I. (Ayurvedic Pharmacopoeia of India)	0.07 (blue), 0.13 (blue), 0.29 (light blue), 0.50 (light pink), 0.60 (light yellow), 0.67 (yellow), 79 (blue), 0.93 (pink).
R_f generated in this research work	0.23, 0.50, 0.66, 0.78, 0.81, 0.84,

Table no.9: R_f value at 254 nm (HPTLC)

Sample	Spots	R_f
O. corymbosa	4	0.03, 0.47, 0.69, 0.77
S. dulcis	6	0.03, 0.05, 0.07, 0.13, 0.44, 0.72
M. oppositifolia	1	0.14
F. indica	7	0.02, 0.19, 0.30,0.47, 0.56,0.68,0.81

Table no. 10: R_f value at 366 nm (HPTLC)

Sample	Spots	R_f
O. corymbosa	2	0.03, 0.82
S. dulcis	5	0.01,0.04, 0.07, 0.14, 0.82
M. oppositifolia	Nil	0.00
F. indica	8	0.02, 0.07,0.09, 0.18, 0.38, 0.48, 0.71, 0.80

Table no.11: R_f value observed with spraying reagent

Sample	Spots	R_f	Colour
O. corymbosa	Nil	0.00	-
S. dulcis	Nil	0.00	-
M. oppositifolia	Nil	0.00	-
F. indica	3	0.30	Orange
		0.60	Orange
		0.83	Green

Figures

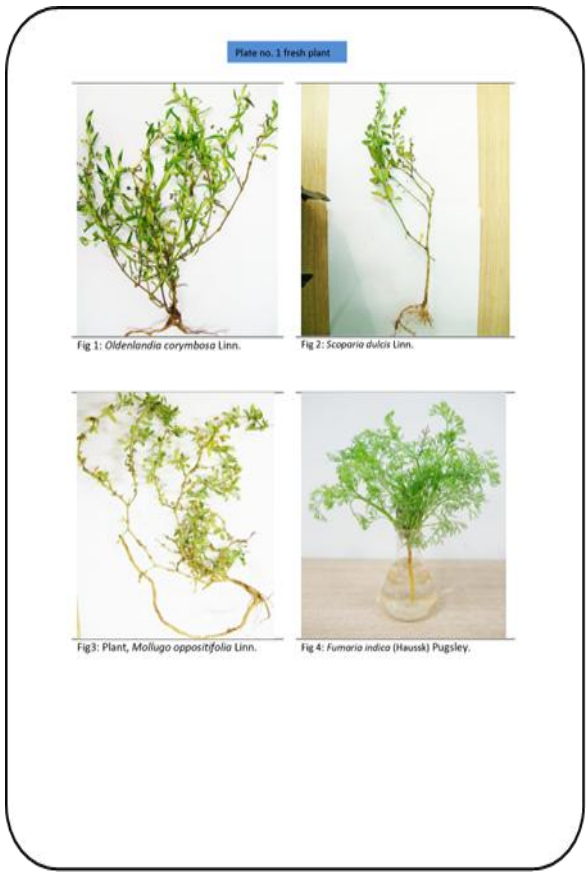


Fig. 1 – 4: Fresh plants

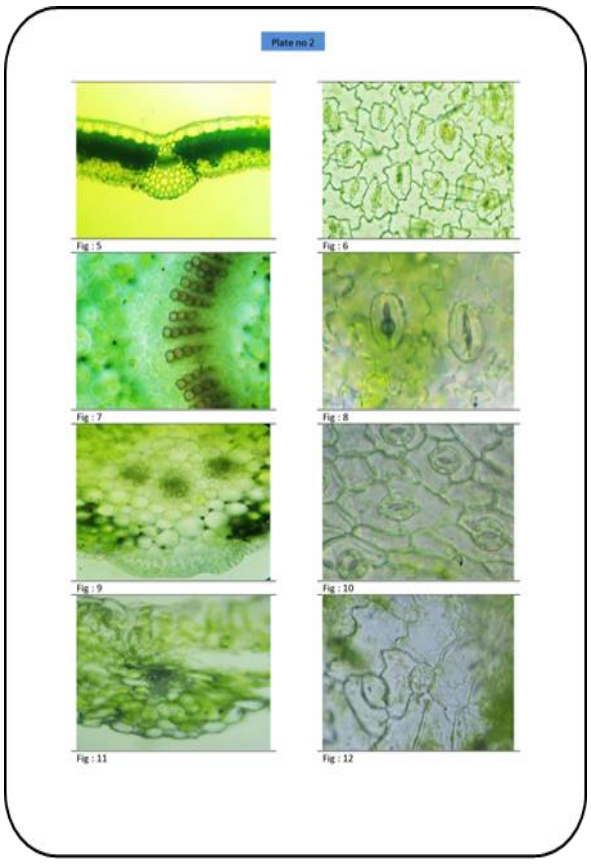


Fig. 5 – 12: T.S through midribs & surface study

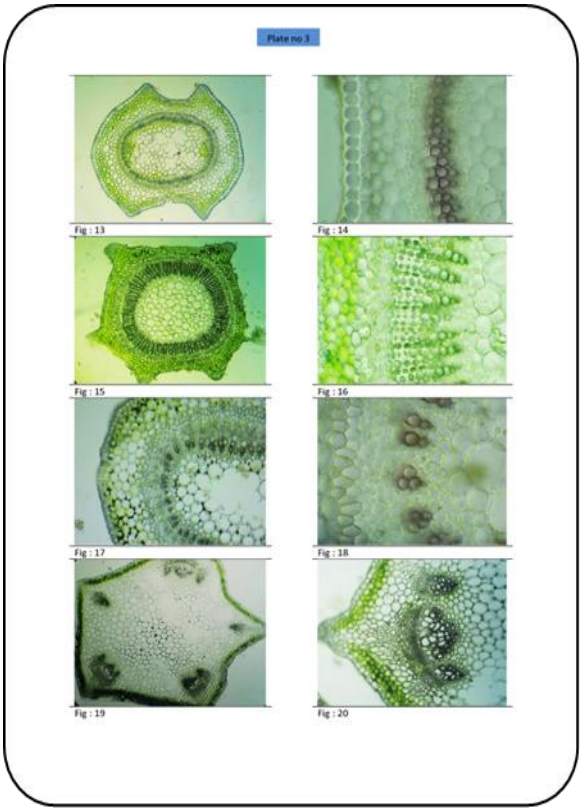


Fig. 13 - 20: T.S of stem

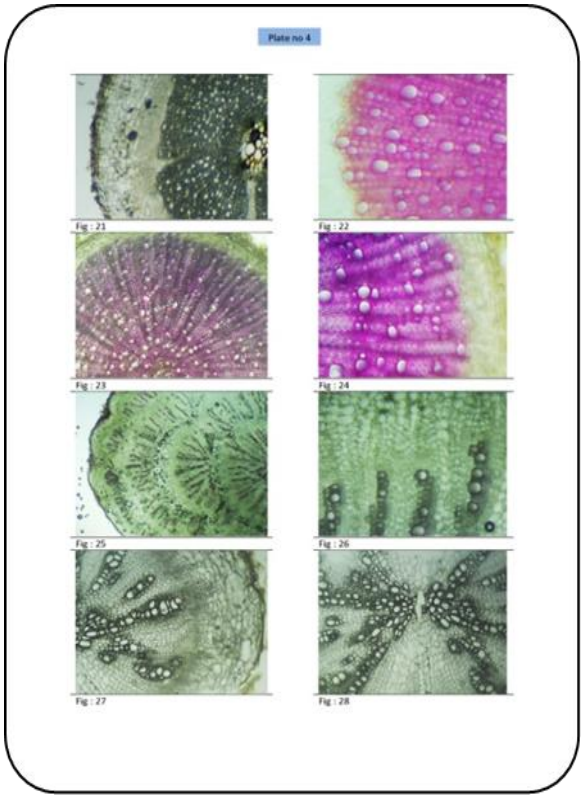


Fig. 21 – 28: T.S of root.

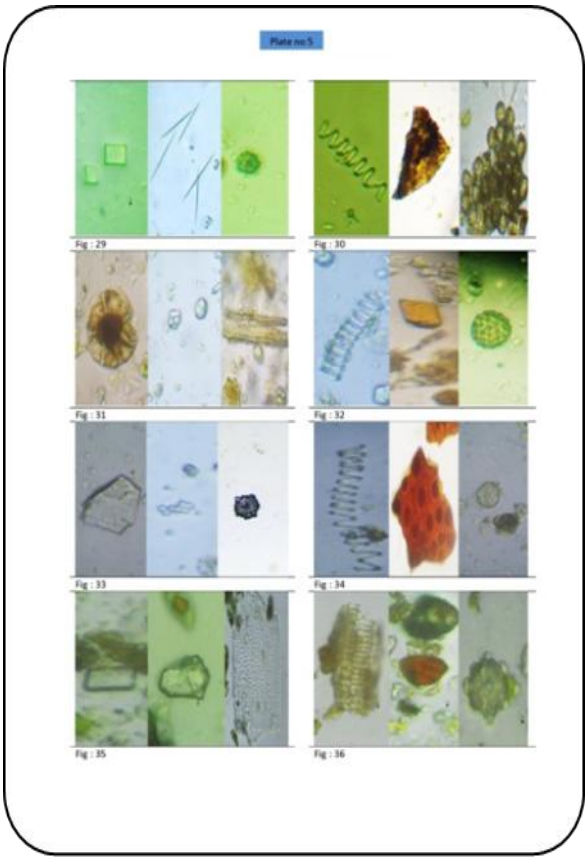


Fig. 29 – 36: Powder characters.

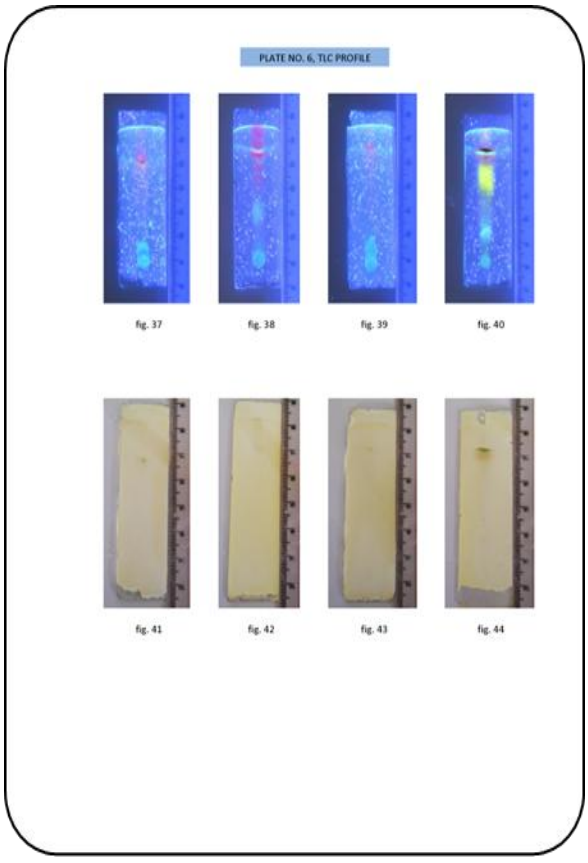
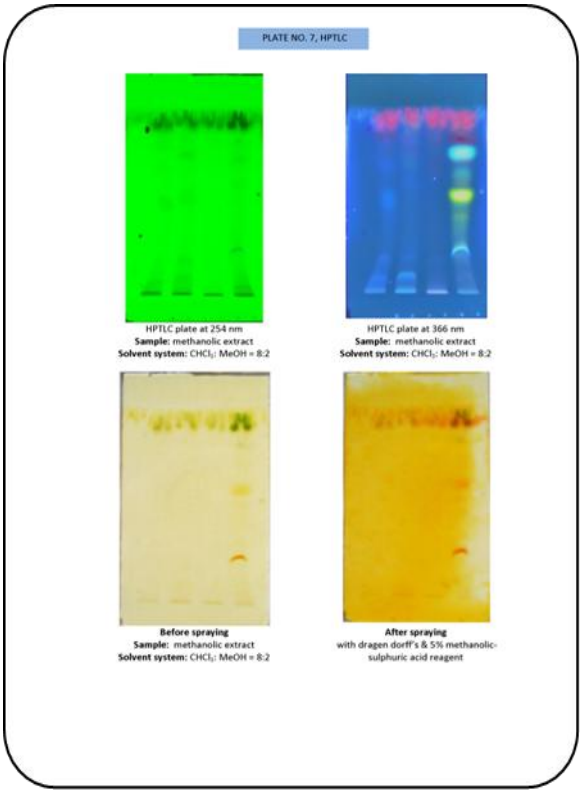
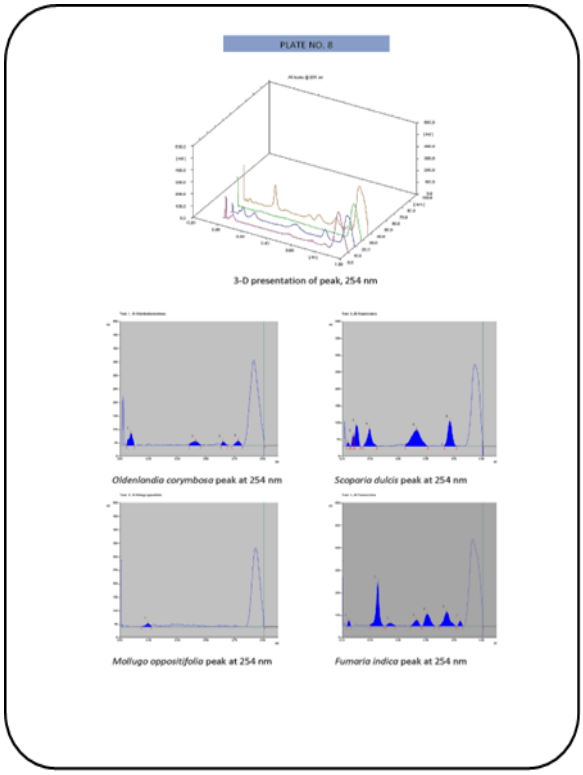


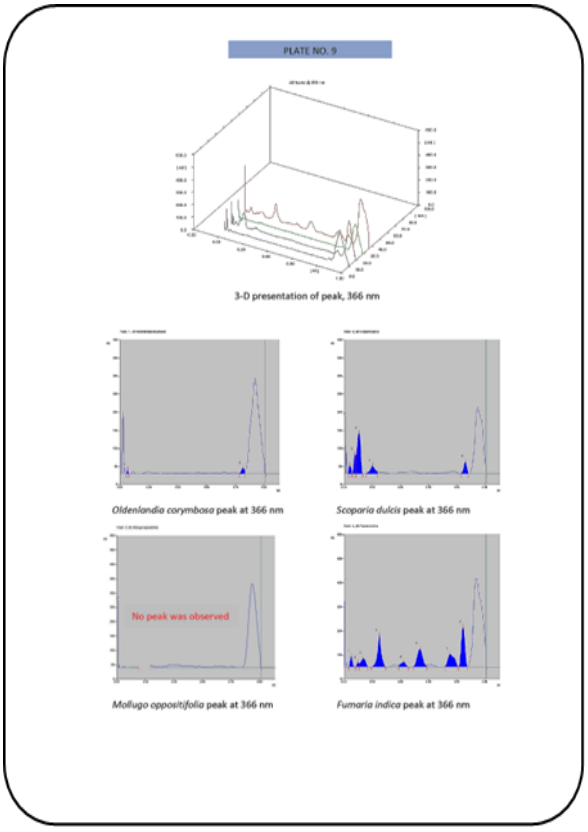
Fig. 37 – 44: TLC plate at 366 nm & after spraying with reagents.



HPTLC plate at 254 nm, 366 nm & after spraying with reagent



HPTLC peak at 254 nm.



HPTLC peak at 366 nm.

Abbreviation

T.S = Transverse Section; P.u.o = parts under observation; t.s.t.m. = transverse section through midrib; u.e. = upper epidermis; l.e. = lower epidermis; u.p = upper palisade; m.l = mesophyll layer; t.s.s = transverse section of stem; e.p.i = epidermis; v.b = vascular bundle; t.s.r = transverse section of root; m.r = medullary rays; m.g.t = multi-cellular glandular trichomes.

Legends

Fig 1: Fresh plant, *Oldenlandia corymbosa* Linn.

Fig 2: Fresh plant, *Scoparia dulcis* Linn.

Fig 3: Fresh Plant, *Mollugo oppositifolia* Linn.

Fig 4: Fresh plant, *Fumaria indica* (Haussk) Pugsley.

Fig 5: Transverse section of leaf through mid-rib, *O. corymbosa* Linn.

Fig 6: Paracytic stomata of *O. corymbosa* Linn.

Fig 7: Transverse section of leaf through mid-rib, *S. dulcis* Linn.

Fig 8: Anisocytic stomata of *S. dulcis* Linn.

Fig 9: Transverse section of leaf through mid-rib, *M. oppositifolia* Linn.

Fig 10: Diacytic stomata of *M. oppositifolia* Linn.

Fig 11: Transverse section of leaf through mid-rib, *F. indica* (Haussk) Pugsley.

Fig 12: Anomocytic stomata of *F. indica* (Haussk) Pugsley.

Fig 13: Transverse section of the stem, *O. corymbosa* Linn.

Fig 14: Cork, cortex, phloem, xylem & pith of the stem, *O. corymbosa* Linn.

Fig 15: Transverse section of the stem, *S. dulcis* Linn.

Fig 16: Cork, cortex, phloem, xylem & pith of the stem, *S. dulcis* Linn.

Fig 17: Transverse section of the stem, *M. oppositifolia* Linn.

Fig 18: Cork, cortex, phloem, xylem & pith of the stem, *M. oppositifolia* Linn.

Fig 19: Transverse section of the stem, *F. indica* (Haussk) Pugsley.

Fig 20: Cork, cortex, phloem, xylem & pith of the stem, *F. indica* (Haussk) Pugsley.

Fig 21: T.S of root showing cork, cortex, phloem & xylem layers of *O. corymbosa* Linn.

Fig 22: Stained xylem & medullary rays of the root, *O. corymbosa* Linn.

Fig 23: T.S of root showing cork, cortex, phloem & xylem layers of *S. dulcis* Linn.

Fig 24: Xylem, m. r. & layers of phloem in the root of *S. dulcis* Linn.

Fig 25: T.S of root showing cork, cortex, phloem & xylem layers of *M. oppositifolia* Linn.

Fig 26: Medullary rays & xylem vessels of the root, *M. oppositifolia* Linn.

Fig 27: T.S of root showing cork, cortex, phloem & xylem layers of *F. indica* Pugsley.

Fig 28: Medullary rays & xylem vessels of the root, *F. indica* (Haussk) Pugsley.

Fig 29: prismatic crystal, acicular crystal, rosette crystal of *O. corymbosa* Powder.

Fig 30: Spiral vessel, tannin content, pollen grain of *O. corymbosa* Powder.

Fig 31: Glandular trichome, compound starch grain, pitted vessel, of *S. dulcis* Powder.

Fig 32: Spiral vessel, tannin content, pollen grain of *S. dulcis* Powder.

Fig 33: Prismatic crystal, starch grain, rosette crystal of *M. oppositifolia* Powder.

Fig 34: Spiral vessel, stone cell with tannin content, pollen grain of *M. oppositifolia* Linn.

Fig 35: Prismatic crystal & pitted vessel of *F. indica* . Powder.

Fig 36: Annular vessel, tannin content, pollen grain of *F. indica* (Haussk) Pugsley.

Fig 37: T.L.C. plate of *O. corymbosa*; at 366; Solvent system:$CHCl_3$: MeOH = 8 : 2

Fig 38: T.L.C. plate of *S. dulcis*; at 366 nm; Solvent system: $CHCl_3$: MeOH = 8 : 2

Fig 39: T.L.C.plate of *M. oppositifolia*; at 366 nm; Solvent system: $CHCl_3$: MeOH = 8 : 2

Fig 40: T.L.C. plate of *F. indica;* at 366 nm; Solvent system: $CHCl_3$: MeOH = 8 : 2

Fig 41: T.L.C. plate of *O. corymbosa*; after spraying with Dragendorff's & Methanolic sulphuric acid reagent.

Fig 42: T.L.C. plate of *S. dulcis*; after spraying with Dragendorff's & Methanolic sulphuric acid reagent.

Fig 43: T.L.C. plate of *M. oppositifolia*; after spraying with Dragendorff's, Methanolic sulphuric acid reagent.

Fig 44: T.L.C. plate of *F. indica*; after spraying with Dragendorff's & Methanolic sulphuric acid reagent.

DISCUSSION

Dr. K. M. Nadkarni in his book 'Indian Materia Medica' wrote that "*F. officinalis* Linn. is not indigenous to India but is imported into the country from Persia. An allied variety, *F. parviflora* Lam, is found in many parts of India from Indo-gangetic and Nepal down to Nilgiri Mountain. The plant found to contain Fumaric acid and Fumarine (an alkaloid)."[32] But in 'The Wealth of India' *Fumaria vaillantii* Loisel. syn. *F. indica* Pugsley has been mentioned & it has been highlighted that – "This species has been wrongly referred to as *F. officinalis* Linn. or *F. Parviflora* Lamk. by many authors."[33] The book further added that "The drug is sold under the name of *Shahterah* or *Pitpapra* and used in stomach derangements, liver complaints & skin affections is fumitory mainly imported from Persia. It

consists of the dried aerial parts of *F. officinalis* Linn., the common fumitory of Europe, and probably also of *F. parviflora* Lam., both of which are not found in India."[33]

It is a very critical claim for justification whether to accept different substitutes in place of original drug or not. Because every time when we accept a substitution we extend the area of the probability factors, rather than having an effort to make it more precise. Sometimes we come across with cases when we do not get the prescribed *dravyas* (drugs) either due to its extinguished existence or due to rare occurrence, and if the cause somehow manages to escape the above two instances, there is another inevitable factor i.e. nothing but the cost factor which ultimately leads to searching for substitution. Accepting the above few instances as exceptional we can overcome the substitution problem by incorporating a system called Categorization of Ayurvedic drug with true identity. With this we can have a very precise & defined window regarding the genuinity & authenticity of the subjected drug.

If we go through the Sanskrit synonyms of *Parpatak* we can find names like *Parpat*, *Suksmapatra*, *Renu* & *Varatikta*. The name *Suksmapatra* indicates plant is having minute or fine leaves. Macroscopical study showed that among the four plants *F. indica* Pugsley & *O. corymbosa* Linn. was having narrow leaves. But *F. indica* Pugsley was having finer leaves as it is also called Fine leaved fumitory in English. While *O. corymbosa* Linn. had have acute & linear kind of leaves. This fact supports *F. indica* Pugsley to be suggested as *Parpatak as* in Sanskrit it is also called *Suksmapatra*.

Renu stands for its little fruits or seeds & *Varatikta* implies for the obvious reason as the *Parpatak* is having *tikta-ras* (bitter taste). Results related to organoleptic character of powder drugs also indicates that *F. indica* Pugsley is bitter in taste & bitter enough to be called "*Varatikta*" in Sanskrit which means its degree of bitterness is high among the bitters. Etymological derivation of *Parpat* shows that it grows in many places [34] (it is found in wheat field as weed). All these synonyms fit perfectly for *Fumaria indica* Pugsley to be authenticated plant source of *Parpatak*.

Microscopic sections of the selected plants & powder characters do not directly contribute to the proposal of *F. indica* to be suggested as *Parpatak*. But all the experimental data regarding these topics can be more than useful in the standardization of *F. indica* Pugsley & also can be handy for authentication of the same.

Trend of modern research work reveals that Protopine,[35, 36] narlumindie,[36] fumariline [37] all belong to alkaloidal group and are reported to have anti-inflammatory, analgesic, hepato-protective activity. All these activity resembles to therapeutic activity of *Parpatak* as mentioned in *Ayurvedic* classics. Although the four selected plants have revealed a pattern of similarities but still having their respective differences & individualities in term of their pharmacological activities. This can be easily assumed that due to this proximity of action those plants are being used as substitute of *Parpatak*. But if we make a comparison between therapeutic activities (karma) of *Parpatak* as mentioned in *Ayurvedic* classics with individual activity-data of the above four drugs, we can precisely single out *Fumaria indica* Pugsley as the suitable candidate for *Parpatak*.

It is rare to observe that Ash value of a plant drug is as high as 24.962 % (*F. indica*) or 22.706 % (*M. oppositifolia*) until & otherwise it is adulterated intentionally or unintentionally. Because it simply indicates high content of inorganic matters. But in present research work sample was collected by the author himself. So point of adulteration can be nullified. But true cause lying behind this kind of result needs further clarification. Although the data generated in this work through Preliminary phytochemical screening are insufficient to proclaim any direct contribution to the proposal suggesting *F. indica* Pugsley as the plant source of *Parpatak*, still it can at least indicate the probabilities in a concise manner.

Data generated in T.L.C. & H.P.T.L.C. profile has not contributed directly to the proposal, suggesting *F. indica* Pugsley as the suitable plant source of *Parpatak*, as classical references don't have such kind of analytical data to compare with; still these data can be useful guide line parameter for the standardization of *F. Indica* Pugsley.

In case of *Parpatak* neither its extinguished existence, rare occurrence nor its cost factor comes out on the pitch to put the logic behind its substitution (as it occurs as weed). Although more than 10 plants have been reported as substitutes of *Parpatak*.

An effort has been made through this research work to solve the controversial aspect regarding the drug *Fumaria indica* Pugsley and to support that various data were generated & had been discussed thoroughly.

CONCLUSION

With all the above reasoning it can be concluded that *Fumaria indica* (Hausk) Pugsley is the most suitable candidate to be proposed as the authentic plant source of *Parpatak*.

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