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CENTRAL COUNCIL FOR RESEARCH IN UNANI MEDICINE
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Editorial

Current trends all over the world have shown that for one reason or the other, people are not only willing to try natural medicine especially those of plant-based but are also actively seeking non-conventional remedies due to the growing recognition, that they are natural and have minimum or no side-effects. Thus, in recent years, there is a growing demand for plant medicines, health products, pharmaceuticals, food supplements, cosmetics etc. in the national and international market. And with this, issues of their quality, safety and efficacy have received renewed attention of scientists associated with researches in traditional drugs, particularly the Unani Medicine. All these ongoing investigations in India and abroad have generated lot of new research data in recent times, and there is an enormous need for exchange of this vital information amongst academicians and researchers engaged in the scientific validation of traditional drugs. In this context, Central Council for Research in Unani Medicine, through its clinical research, drug standardization, literary research and survey & cultivation of medicinal plants programmes, is contributing significantly for over three decades. Vitiligo, sinusitis, filariasis, eczema, malaria, infective hepatitis, asthma are some of the conditions where Unani therapies have earned recognition.

The Council has been publishing the peer reviewed Hippocratic Journal of Unani Medicine (HJUM), mainly to bring out fundamental and applied aspects of Unani Medicine. The journal also publishes recent advances in other related sciences and traditional medicines as well as different streams of medical sciences, which have bearing on validation and scientific interpretation of various concepts and strengths of Unani Medicine.

In view of an overwhelming response, the journal earlier published twice a year, its periodicity had been changed to quarterly w.e.f. January 2008 to accommodate more articles for quick dissemination of research data among scientific community. The journal has sufficient room for invited articles from luminaries of modern medicine and sciences as well as scholars of Unani Medicine. The broad areas being covered include clinical research on single and compound Unani drugs, validation of regimental therapy, experimental pharmacological studies, standardization of single and compound drugs, development of standard operating procedures, ethnobotanical studies and development of agro-techniques thereof, and literary research on classics of Unani Medicine. The journal is also open for studies on safety evaluation of Unani and other herbo-mineral drugs, nutraceuticals, cosmotherapeutics, aromatics, oral health, life style disorders, sports medicine, etc. and such other newer areas which are the outcome of modern day living.

This issue of the journal is a backlog issue which corresponds to October – December 2016. It contains 15 original and review papers in the areas of: Clinical and Fundamental research, Drug standardization, Experimental Pharmacology, Biochemistry, Ethnopharmacology and allied disciplines contributed by eminent scholars in their respective fields. It is hoped that data presented will contribute significantly in R&D sector of traditional drugs and prove to be an excellent exposition of current research efforts of scientists in this direction. The CCRUM acknowledges the authors for their contributions included in this issue and hope for their continued support in this endeavor. We wish to ensure the readers to bring out the future issues of the journal on time.

We at the CCRUM have been constantly striving to reach to higher standards and make the HJUM the leading journal of Unani Medicine and related sciences. In this context, we thank our learned reviewers for their invaluable inputs in improving the manuscripts. We sincerely hope and trust that the mission can be accomplished with active partnership of quality-conscious individuals and institutions. Through these lines we seek your cooperation and support in materializing our dreams about the HJUM. In this regard, we request you for your as well as your colleagues' contributions for publication in and subscription to the journal. Further, we will appreciate if the journal is introduced far and wide. We would also welcome esteemed suggestions for achieving the highest standards of quality for the journal.

March 24, 2017

(**Prof. Vd. K.S. Dhiman)**
Director General

Organoleptic and Physiochemical Characterization of Suranjan Talkh (*Colchicum luteum* Baker)- An Anti-Arthritic Unani Drug

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Abstract

Due to natural variations a number of natural products have significantly different biological activity and varied clinical efficacy. Further, a large number of drugs are confounded with each other due to resemblance in their physicochemical characteristics. Therefore, it becomes imperative to standardize the herbal drugs to ensure their identity, quality and purity so as to ascertain their therapeutic efficacy. Suranjan Talkh *(Colchicum luteum)* is an important drug of Unani Medicine commonly used in the management of Waja ul Mufasil (Arthritis). It is confounded with its other species like *Colchicum autumnale, Merendra persica, Colchicum speciosum* etc. So, in the present study an attempt has been made to determine the physicochemical characters helpful in identification, standardization and quality control of Suranjan Talkh. It includes the parameters used in National Unani Pharmacopeia i.e. Ash values (Total ash, acid insoluble ash, water soluble ash), successive extractive values, solubility in alcohol and water, loss on drying, pH at 1% & 10%, bulk density and moisture content. Qualitative analysis and Chromatographic study (TLC) were also performed.

Keywords: Standardization, Suranjan Talkh, *Colchicum luteum* Baker, TLC.

Introduction

Suranjan Talkh (*Colchicum luteum* Baker) is an annual plant belongs to the family Colchicaceae. It is an Indian colchicum found along the margins of North-Western Himalayas from Kashmir to Chambal between 700 to 2800 m altitudes (Bhattacharjee, 2004). The plant is the earliest one to flower after the snow melts. According to Ibn Sina (980-1037) the flower of Suranjan is the first to appear in spring in the moist valleys beneath the mountains. In Unani medicine the corms of Suranjan Talkh are mainly used for medicinal purpose. The corm is pale yellow to deep brown in colour with a tapering apex and prominent groove on one side. The corms are of varying size but mostly they are 30-45 mm long, 10-16 mm wide and 7-12 mm thick (Wallis, 1985). These are somewhat conical, ovoid or elongated and surface is marked by indefinite and irregular longitudinal striations. These are odorless and have a bitter and acrid taste (Anonymous, 2001). Suranjan Talkh possesses carminative, alterative, aperients, laxative, anti-inflammatory, analgesic and aphrodisiac action (Kirtikar and Basu, 1996). Its therapeutic efficacy in arthritis can be understood by the fact that its powder is used as a standard drug in clinical trials of patients suffering from osteoarthritis, rheumatism and gout. It is effective in other inflammatory diseases like piles, hepatitis, splenomegaly and meningitis (Kirtikar and Basu, 1996). It is also prescribed to treat myeloid leukemia. Its active constituent colchicine is used to

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produce polyploidy in biological experiments. Anti-cancer activity of colchicum has also been reported (Ali, 1993). Suranjan Shirin and few drugs of other species are mutually confused with each other due to their morphological resemblance and used in place of each other without knowing the difference in their efficacy and toxicity. So after standardizing both the species and evaluating pharmacological efficacy we will be able to use them in the management of different types of arthritis. Present study has been designed to study Suranjan Talkh on certain physicochemical parameters in order to set the standards of its quality and purity.

Material and Methods

The drug sample of Suranjan Talkh (*Colchicum luteum* Baker) was procured from the local market of Aligarh and botanically identified by the then Professor S. H. Afaq, Pharmacognosy Section, Department of Ilmul Advia, A. K. Tibbiya College, Aligarh Muslim University, Aligarh. The sample was further authenticated by National Institute of Science Communication and Information Resources (NISCAIR), New Delhi (NISCAIR/RHMD/Consult/2015/2844/37-1). The sample of the test drug was deposited to Mawalid-e-Salasa Museum of the Department, for future reference with the voucher No of SC-0171/15.

The corms of Suranjan Talkh were ground to get coarse powder. The powder was then subjected to physicochemical and phytochemical studies to determine various constants.

Determination of Organoleptic Characteristics

Organoleptic evaluation refers to evaluation of the drug by its appearance, colour, odour, taste and texture (Table-1).

Physicochemical Study

The Physicochemical study included the determination of extractive values of the test drug in different solvents, moisture content, ash values, loss of weight on drying, bulk density and pH values (Table-2).

Ash values

Total Ash

About 2 to 3 gm accurately weighed powdered drug was incinerated in silica dish at a temperature not exceeding 450C, until free from carbon. It was then cooled and weighed. The percentage of ash was calculated with reference to air dried drug (Anonymous, 2007).

Water Soluble Ash

The ash was boiled for 5 minutes with 25 ml of water. The insoluble matter was collected on an ash less filter paper, washed with hot water, and ignited for 15 minutes at a temperature not exceeding 450C. The weight of the insoluble matter was subtracted from the weight of the ash; the difference in weight represented the water soluble ash.

The percentage of water soluble ash was calculated with reference to air dried drug (Anonymous, 2007).

Acid Insoluble Ash

The ash was boiled for 5 minutes with 25 ml of dilute hydrochloric acid. The insoluble matter was collected on ash less filter paper, washed with hot water and ignited to constant weight.

The percentage of acid insoluble ash was calculated with reference to the air dried drug (Anonymous, 2007).

Determination of Alcohol-soluble extractive

5 gm of the air dried, coarsely powdered drug was macerated with 100 ml of alcohol of the specified strength (90%) in a closed flask for twenty-four hours, shaking frequently during six hours and allowing to stand for eighteen hours. It was filtered rapidly, taking precautions against loss of solvent. 25 ml of the filtrate was evaporated to dryness in a flat bottomed shallow dish, and dried at 105°, to constant weight. The percentage of alcohol-soluble extractive was calculated with reference to the air dried drug (Anonymous, 2007).

Determination of Water-soluble extractive

5 gm of the air dried, coarsely powdered drug was macerated with 100 ml of water in a closed flask for twenty-four hours, shaking frequently during six hours and allowing to stand for eighteen hours. It was filtered rapidly, taking precautions against loss of solvent. 25 ml of the filtrate was evaporated to dryness in a flat bottomed shallow dish, and dried at 105°, to constant weight. The percentage of water soluble extractive was calculated with reference to the air dried drug (Anonymous, 2007).

Moisture Content

The drug was kept in a flask along with sufficient quantity of toluene. The level of toluene was kept above the level of drug to allow the later to get submerged. Then it was distilled for sufficient time. The distillate was collected in a measuring

receiver along with the toluene, and a separated upper layer was measured in the receiver (Afaq *et al*., 1994).

Loss of Weight on Drying

The known weight of the test drug was taken, spread uniformly and thin layered in a shallow Petri dish. It was heated at a regulated temperature of 105°C, cooled in a desiccator and weighed. The process was repeated many times till two consecutive weights were found constant. The percentage of loss in weight was calculated with respect to initial weight (Jenkins *et al*., 1994).

pH Value

Determination of pH was carried out by a synchronic digital pH meter (model no. 335) equipped with a combined electrode. The instrument was standardized by using buffer solution of 4.0, 7.0, and 9.20 to ascertain the accuracy of the instrument prior to the experiment. The pH value of 1% and 10% aqueous solution of powdered drug was measured (Anonymous, 2007).

Bulk Density

A clean, dry and previously washed bottle of 25 ml capacity was filled with 10 ml of distilled water and weighed and marked at the water level. It was then emptied, rinsed with acetone and dried. Bottle was filled with powdered drug and allowed to settle overnight and the level was adjusted to the specific mark and weighed. The bulk density was calculated from the weight of water and drug (Anonymous, 2007).

Qualitative Analysis

The qualitative analysis of different chemical constituents, present in test drug was carried out according to the scheme proposed by Bhattacharjee and Das (1969). The powder of the test drug was extracted with petroleum ether (BP.60-80°C). The petroleum ether extract (I) was tested for free phenols, alkaloids and sterols/terpenes. A part of this extract was saponified and this portion (II) was tested for fatty acids, whereas, unsaponified portion (III) was tested again for phenols, and sterols/terpenes for confirmation. The defatted marc was divided into two portions. One portion was extracted with hot water and the other with ethanol (70%). The aqueous (IV) and alcoholic (V) extracts were tested for alkaloids, flavonoids, saponins, sugars and tannins. Aqueous extract was extracted with ether and ether soluble portion (VI) was tested again for alkaloids, sterols/terpenes, whereas, water-soluble portion (VII) was tested for glycosides. The water-soluble portion was again hydrolyzed with 5% hydrochloric acid and

extracted with chloroform. The aglycone portion (VIII) was tested for insoluble hydrochloride of alkaloid. Chloroform soluble portion (IX) was tested for alkaloids and sterols/terpenes, whereas water-soluble fraction (X) was tested for alkaloids. One part of this water-soluble portion was basified with alkali (ammonia) and extracted with immiscible solvent (ether). The solvent soluble part (XI) was again tested for alkaloids (Afaq *et al*., 1994) (Table-3).

Test for Alkaloids

A drop of Dragendroff's reagent was added in the extract. The brown precipitate showed the presence of alkaloids.

Test for Carbohydrate / Sugars

Fehling's Test

In the aqueous extract, a mixture of equal parts of Fehling's solution A and B previously mixed, was added and heated. A brick red precipitate of cuprous oxide indicates the presence of reducing sugars.

Molisch test

In an aqueous extract, α-napthol was added. Afterwards, concentrated sulphuric acid was gently poured. A brown colour ring at the junction of the two solutions indicates the presence of the sugar.

Test for Flavonoids

A piece of Magnesium ribbon was added to the alcoholic extract of the drug followed by drop wise addition of concentrated Hcl. Colour ranging from orange pink to red is a confirmatory test for flavonoids.

Test for Glycosides

The test solution was filtered and sugar was removed by fermentation with baker's yeast. The acid was removed by precipitation with magnesium oxide. The remaining alcoholic extract that contained the glycosides was subsequently detected by the following method:

The hydrolysis of the solution was done with concentrated sulphuric acid and after the hydrolysis sugar was determined with the help of Fehling's solutions.

Test for Tannin

Ferric chloride solution was added in the aqueous extract of the drug. A bluish-

black colour, which disappeared on addition of dilute sulphuric acid followed by a yellowish brown precipitate, shows the presence of tannin.

Test for Proteins

Xanthoproteinic reaction

In the test solution, concentrated nitric acid was added. A yellow precipitate appeared. Strong solution of ammonia was added to it. Appearance of yellow colour, shows the presence of proteins.

Biurette´s reaction

In the hot test solution, 1ml concentrated sodium hydroxide was added, followed by one drop of copper sulphate solution. A violet or red colour indicates the presence of proteins.

Test for Starch

0.015 gm of Iodine and 0.015 gm of Potassium Iodide was added in 5 ml of distilled water; 2 ml of iodine solution formed was added to 2 ml of aqueous test solution, the presence of blue colour indicates the presence of starch.

Test for Phenol

5– 8 drops of 1% aqueous solution of Lead acetate was added to aqueous or alcoholic test solution. The presence of yellow coloured precipitate indicates the presence of phenols.

Test for Sterol/Terpenes

Salkowski reaction

In the test solution of chloroform 2 ml sulphuric acid (concentrated) was mixed from the side of the test tube. The colour of the ring at the junction of the two layers was observed. A red colour ring indicates the presence of the sterols/ terpenes.

Test for Amino Acids

The alcoholic extract was mixed with ninhydrin solution (0.1% in acetone). After heating gently on water bath for few minutes it gives a blue to red-violet colour that indicates the presence of amino acids.

Test for Resin

The test solution was gently heated and acetic anhydride was added to it. After cooling, one drop of sulphuric acid was mixed. A purplish red colour that rapidly changed to violet indicates the presence of the resins.

Thin Layer Chromatography

Thin Layer Chromatography of petroleum ether extract of drug was carried out on aluminium plates precoated with Silica gel-G (Layer thickness 0.20-0.25 mm) for all extracts in various phases later sprayed by different spraying reagents. The Rf value of spots was calculated by the following formulae (Anonymous, 2007).

Rf Value - Distance travelled by the spot / Distance travelled by the solvent

Observations and Results

The findings of the tests carried out have been given below in table 1-4 and figure 1-2:

Table 1: Organoleptic characters

S.No.	Organoleptic characters	Observations
1.	Appearance	Solid and ovoid
2.	Colour	Pale yellow to dark brown
3.	Odour	Inodorous
4.	Texture	Firm and smooth
5.	Taste	Bitter

The amount of total ash, water soluble ash and acid insoluble ash of Suranjan Talkh (*Colchicum luteum*) are 6.543±0.2014, 2.12±0.0425 and 1.314±0.78754 respectively. Percentage of loss of weight on drying, moisture content and bulk density were found to be 9.63±0.01453, 1.01±0.008819 and 0.904±0.001732 for Suranjan Talkh. pH of the Suranjan Talkh was found to be 7.20±0.02404 in 1 % solution and 7.32±0.04726 in 10% solution. The percentage of extractive values of Suranjan Talkh (*Colchicum autumnale*) by successive extraction with different solvents was found to be 0.68±0.007412 in Petroleum ether, 0.38± 0.4581 in Chloroform, 0.42± 0.00452 in Acetone, 1.34 ± 0.8954 in Alcohol and 8.25± 0.004521 in Distilled water.

Table 2: Physicoch\emical parameters

S.No.	Parameters	Results
1.	Ash value	Total Ash: 6.543±0.20141 Water soluble: 2.12±0.04253 Acid Insoluble Ash: 1.314±0.78754
2.	Moisture content	1.01±0.008819

3.	Bulk density	0.904±0.001732	
4.	Loss on drying at 105°C	9.63±0.01453	
5.	pH values	1 % pH-	7.20±0.02404
		10 % pH-	7.32±0.04726
6.	Extractive values	Petroleum ether	0.68±0.007412
		Chloroform	0.38± 0.4581
		Acetone	0.42± 0.00452
		Alcohol	1.34 ± 0.8954
		Distilled water	8.25± 0.004521

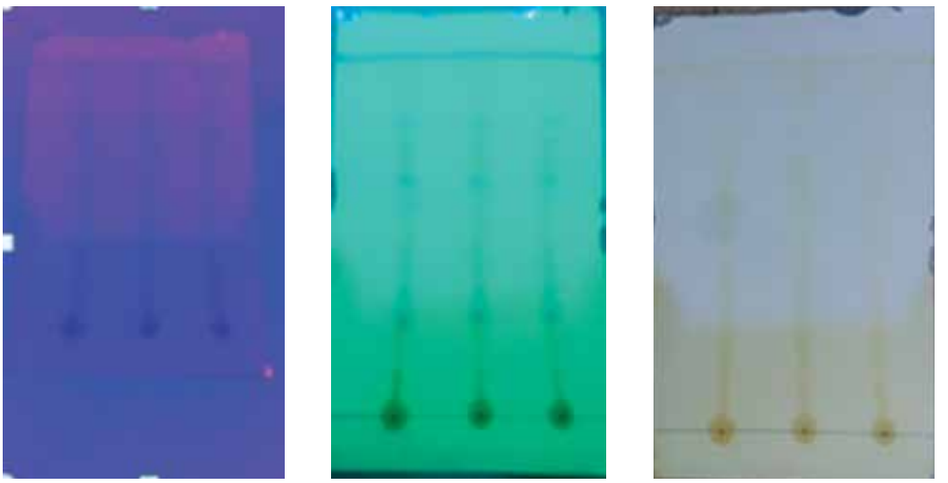
The Qualitative test for chemical constituents demonstrated that alkaloids, glycosides, proteins, amino acids, tannins, resins, steroids and saponins were present in Suranjan Talkh (*Colchicum luteum*).

Table 3: Qualitative analysis

S.No.	Chemical constituents	Tests/reagent	Inference
1.	Alkaloid	Dragendroff´s reagent	+
		Hager´s test	+
		Mayer´s reagent	+
2.	Carbohydrate	Molisch´s Test	-
		Fehling´s test	-
3.	Glycoside	NaOH Test	+
4.	Flavanoids	Mg ribbon and Dil. Hcl	-
5.	Tannin	Ferric chloride test	+
6.	Protein	Xanthoproteinic test	+
		Biurette´s test	-
7.	Steroid	Salkowski reaction	+
8.	Amino acid	Ninhydrin solution	+
9.	Resins	Acetic Anhydride Test	+
10.	Phenol	Lead acetate Test	-
11.	Saponin	Frothing with NaHCO3	+

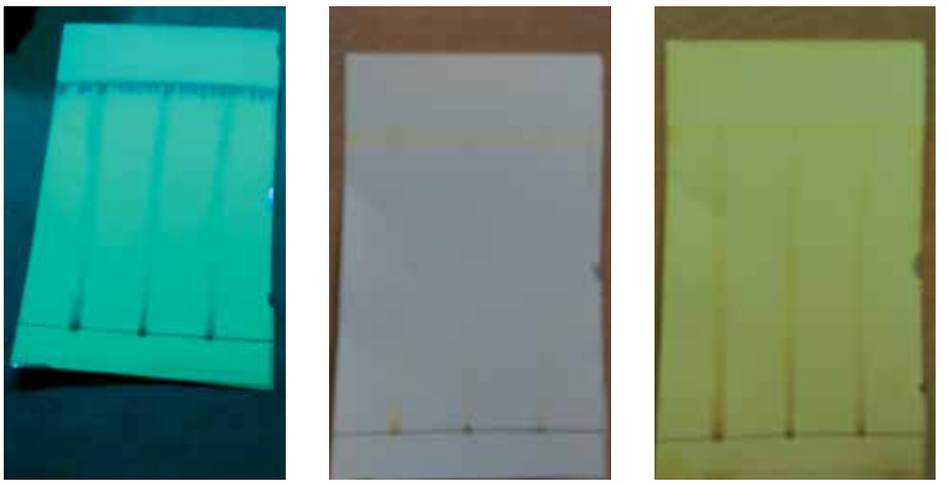
Table 4: TLC profile

Extract	Solvent System	Treatment	No. of spots	Rf value
Petroleum ether	Petroleum ether: Diethyl ether (2:1)	UV Long	3	I - 0.425
		UV Short	3	II - 0.675
		Visible light	3	III - 0.712
		Iodine vapour	3	
Alcohol	n-Butanol: Acetic acid:water (5:1:4)	UV Long	1	0.75
		UV Short	2	0.75, 0.89
		Visible light	1	0.75
		Iodine vapour	1	0.75



UV long UV short Iodine vapours

Fig 1: TLC of Petroleum Ether extract of Suranjan Talkh (*Colchicum luteum*)



UV Light Visible light Iodine vapour

Fig 2: TLC of Alcoholic extract of Suranjan Talkh (*Colchicum luteum*)

Discussion

In recent years, there has been great demand for plant derived drugs globally. Standardisation is an essential tool to ensure identity, purity and quality of herbal drugs. Pharmacognostical studies are the first step of standardisation which helps in identification, characterization and distinguishing the drug from confounding varieties. Since the therapeutic efficacy of a drug mainly depends upon its physicochemical characteristics therefore, the determination of physicochemical characters for the authenticity of a drug is imperative before studying it for pharmacological activity. Physicochemical study helps in characterization of constituents or groups of constituents which interact at molecular level in human beings. It must be appreciated that Unani Drugs produce effects mostly due to their Mizaj as they modify the deranged Mizaj and Kaifiyat of the human body and brought them back to normal level. Since specific temperament (Mizaj) develops because of the unique configuration of the constituents that a drug possesses therefore little change in physicochemical characters may modify the temperament of the drug compromising its ability to deal with the pathological condition.

Standardization of Suranjan Talkh (*Colchicum luteum*) which is an effective anti-arthritic drug will ensure its proper identification, purity and quality and thereby its therapeutic efficacy. The findings of the present study will also help in distinguishing it from confounding varieties mainly *Colchicum autumnale* and *Marendra persica* which possess few common characters and stimulating pharmacological effect. The former is more commonly used in Unani medicine and is considered a bit safe as compared to the test drug. However, since both have different physichochemical and phytochemical characters, therefore, their pharmacological effect and the degree of effect vary. Therefore, their characters must be defined. Standardization is also mandatory because deviation from the normal in terms of quality and quantity of the constituents may alter the efficacy and safety of the drug. The present study determines a comprehensive range of physicochemical characters of the drug according to the parameters used in National Formulary of Unani Medicine. Therefore, these findings may be used as the standards for ensuring the purity and quality and thereby the predictable efficacy and safety of Suranjan Talkh.

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Status of Oestradiol (E2) and Progesterone Hormone in Female Vitiligo Patients in South Indian Populations (A Preliminary Study)

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Abstract

Vitiligo is an autoimmune depigmenting disorder that affects 0.5% to 2% world population and pathogenesis of vitiligo is still an enigma. Many hypothesis for the pathogenesis of vitiligo has been implicated including stress, neural abnormalities, melatonin receptor dysfunction, impaired melanocyte migration, genetic susceptibility, biochemical defects and autoimmunity but actual etiopathogenesis of this disease is still unknown. The role of sex hormones in the pathogenesis of different autoimmune disorders has considerable interest because sex hormone might exert their immune-modulating effects.

In this study, we aimed to investigate sex hormone estrogen and progesterone. 31 female patients suffering from vitiligo were enrolled at Central Research Institute of Unani Medicine, Hyderabad. Oestradiol and progesterone were estimated by enzyme immunoassay. The results showed that out of 31 female patients, 17 patients had oestradiol level within normal limit (263 ± 100) and 14 patients had above normal limit (521 ± 88.6). This change was significantly ($p<0.001$) higher, double in the patients above normal limits than the patients within normal limit. Out of 31 female patients, 28 patients had the level of progesterone hormone within normal limit (0.83 ± 0.36) and only 3 patients had level of progesterone above normal limit (6.14 ± 2.79). These changes were significantly ($p<0.001$) seven times greater in patients above normal limits than the patients within normal limit of progesterone. The results of our study advocates the previous studies that estrogen may play an important role in pathogenesis of vitiligo and also concluded the progesterone may be associated in the pathogenesis of vitiligo and suggested that study should be conducted in large number of sample.

Key words: Estrogen, Progesterone, Vitiligo, Hormone, Enzyme immunoassay

Introduction

Vitiligo is an acquired, relatively idiopathic loss of constitutive pigment from the skin manifested by well circumscribed depigmented patches with loss of melanin. It occurs on any part of the body and any time in life (Ortonne and Bose, 1993). It is the most common depigmenting disorder that affects 0.5% to 2% world population and peaks upto 8.8% reported in india (Picardo *et al*., 2015). Many hypothesis for the pathogenesis of vitiligo has been implicated including stress, neural abnormalities, melatonin receptor dysfunction, impaired melanocyte migration, genetic susceptibility, biochemical defects and autoimmunity but actual etiopathogenesis of this disease is still an enigma (Taieb, 2000).

Sex steroid hormones including estrogen and progesterone have been traditionally identified for their role in reproduction. The physiological effects of

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estrogen and progesterone are well known but limited information are available for their pathophysiological effect in genesis of various disorders. Estrogen and progesterone are considered to be involved in development and progression of cardiovascular disorder and various autoimmune disorders. The average menstrual cycle of 28 days (23–29 days) is divided into three phases. One is the first phase estrogen-dominated phase also called follicular phase, second is secretory or luteal phase, this is due to an increase in progesterone secretion causing a coiling of the endometrial vessels and a thickening of the endometrium. In the last phase, the menstrual phase, there is a decrease in all the ovarian hormones which, in turn, decreases the production of all anterior pituitary reproductive hormones (Dullo and Vedi, 2008). The role of estrogen in production of H_2O_2 is well reported (Schallreuter *et al*., 2006). So we enrolled those female vitiligo patients who were in the late follicular phase. In an effort to study the role of estrogen and progesterone in vitiligo a preliminary study was conducted.

Material and Methods

The present study was carried out at Central Research Institute of Unani Medicine (CRIUM), Hyderabad during the period of 2008-2010

Selection of the patients

31 female vitiligo patients from the age groups 16-45 years under late follicular phase, who met the exclusion and inclusion criteria, were enrolled for this study. The study was allotted by the CCRUM, New Delhi

Collection of Blood Sample

Blood sample was collected for estimation of estradiol and progesterone sent from Vitiligo Unit of CRIUM, Hyderabad. Serum was separated by centrifuging the clotted blood at 3000 rpm for 10 minutes. After serum separation it was kept at -200C for hormone estimation.

Estimation of serum estradiol and progesterone hormone was done by Enzyme Immunoassay (EIA)

Concentration of estradiol and progesterone hormone in the serum was estimated by EIA kits from Omega diagnostic pvt ltd U.K. The procedure for estimation of serum estradiol and progesterone hormone were same. In this procedure 96 wells microplate were used. 25 µl oestraiol-HRP conjugate was added in each well followed by addition of 50 µl Rabbit anti-oestradiol. It was mixed for 30 sec and then incubated at room temperature for 90 minutes. The content of wells were discarded and washed thoroughly (10 times) by adding 300 µl double distilled water in each well. 100 µl substrate solution was added to each well

and mixed gently for 5 sec and incubated the plate in dark at room temperature for 20 minutes. Then 100 µl stock solution was added to each well, mixed gently for 30 seconds and the colour change from blue to yellow was measured spectrophotometrically at a wavelength of 450 nm. For estimation of progesterone, progesterone-HRP conjugate and Rabbit anti-progesterone were added in the wells and the remaining steps were same. The concentration of oestrogen and progesterone in the samples were then determined by comparing the optical density of the samples with standard curve.

The normal reference range for serum estradiol was 100-400 pg/ml and progesterone was 0.1-1.6 pg/ml. These values were used to confirm abnormal values and then to find association between estradiaol and progesterone levels in vitiligo patients.

Statistical Analysis

For the statistical data analysis using student t' test, we used software from graphpad.com available online to see the correlation between normal and abnormal level of hormones in vitiligo patients.

Table 1: Status of estrogens and progesterone hormone in vitiligo female patients

S. No	Hormones	No. of patients within normal limits	Hormone level within normal limits (mean ± SD)	No. of patients above normal limits	Hormone level above normal limits (mean ± SD)	Normal reference range values
1	Oestradiol (E2) pg/ml	17	(263 ± 100)	14	(521 ± 88.6)*	Late follicular phase: 100-400 pg/ml
2	Progesterone pg/ml	28	(0.83 ± 0.36)	03	(6.14 ± 2.79)*	Late follicular phase: 0.10-1.60 ng/ml

Values in brackets indicated oestradiol and progesterone level in pg/ml. Changes between hormone level within normal limits and above normal limits was highly significant *P<0.0001. The abnormal level of oestradiol (E2) was two times higher than the vitiligo patients having hormone within normal limit and abnormal level of progesterone was seven times higher than the vitiligo patients having hormone within normal limits.

Table 2: Distribution of patients according to the chronicity of the disease

S. No.	Chronicity of disease	No. of patients	percentage
1.	Less than 6 month	01	3.2
2.	1-2 year	12	38.7
3.	3-5 year	07	22.6
4.	6-10 year	06	19.4
5.	11-15 years	01	3.2
6.	16-20 year	03	9.7
7.	21-30 year	01	3.2

According to the chronicity the highest number of patients who had vitiligo from 1-2 years, was 12, one patients had vitiligo from less than 6 month, 7 patients had vitiligo from 3-5 years, 6 patients had vitiligo from 6-10 years, 01 patient had vitiligo from 11-15 years, 03 patients had vitiligo 16-20 years and one patient had vitiligo from 21-30 years.

Results and Discussions

Vitiligo is a depigmenting disorder which affects both male and female and occurs at any age of life. There are many hypothesis for the etiopathogenesis of vitiligo but all are under discussion. In the present study, it showed that out of 31 female vitiligo patients, 17 patients had estradiol level within normal limit (263 ± 100), 14 patients had above normal limit (521 ± 88.6) and this level was significantly two times higher. Out of 31 female vitiligo patients, 28 patients had the level of progesterone hormone within normal limit (0.83 ± 0.36), only 3 patients had level of progesterone above normal limit (6.14 ± 2.79) and this level was significantly seven times higher (Results are depicted in Table-1). According to the chronicity the highest number of patients who had been suffering from vitiligo for 1-2 years, was 12, one patient had vitiligo from less than 6 month, 7 patients had vitiligo from 3-5 years, 6 patients had vitiligo from 6-10 years, 01 patient had vitiligo from 11-15 years, 03 patients had vitiligo from 16-20 years and one patient had vitiligo from 21-30 years (Results are depicted in Table-2).

Estrogen and progesterone are considered to be female sex hormones. Apart from reproduction, they also play a widespread role in cardiovascular diseases, neurodegenerative, autoimmune disorders and breast cancer. Both hormone affect calcium metabolism and thus prevent the occurrence and progression of osteoporosis. Estrogen and progesterone exert their action through estrogen receptors α and β, and progesterone receptor A and B respectively via genomic and non-genomic pathways. The role of oestrogen and progesterone in the development of various diseases is complex and controversial (Parikh and Gohil, 2014).

It has been suggested from a long time that estrogens may be involved in the depigmentation process of vitiligo because the initiation/progression of the disease is observed at pregnancy, in the menopause, after the use of oral contraceptives, hormonal substitution, postpartum, (Levai, 1958; Behl and Bhatia, 1972; Dutta and Mandal, 1969; Salzer and Schallreuter, 1995 Lerner, 1959). In a study reported by Anderson *et al*., 2003, it is worth noting that the generation of H2O2 by estrogens and other aromatic steroids (e.g. progesterone) can contribute to DNA damage as shown in human peripheral blood lymphocytes and in spermatozoa. Utilizing the comet assay, the results of their study showed that estrogens do indeed contribute to the oxidative stress via H_2O_2 in lymphocytes, leading to DNA damage in these cells. (Anderson *et al*., 2003). Schallreuter *et al*., 2006 identified a direct effect of the estrogen, which was not prevented by catalase, demonstrating that semiquinone and orthoquinone metabolites from the hormone can contribute to DNA damage. Estrogens are also produced in the human epidermis and propose that estrogen-induced oxidative/radical stress could provide a rationale for hormonal-induced vitiligo. A recent study reported that there was a statistically significant difference in serum estrogen and ERβ in vitiligo female and male patients compared to their controls; results of this study might highlight their possible role in the pathogenesis of vitiligo (Sabek *et al*., 2015).

The results of our study suggest that the estrogen might play an important role in the pathogenesis of vitiligo and there were only three patients having abnormal level of progesterone which were significantly seven times higher than the normal level in vitiligo patients and the results suggest that estrogen and to some extent progesterone may be associated in the pathogenesis of vitiligo. These are only preliminary findings. It may be suggested that the study may be conducted on a larger sample size.

Conclusions

The results of our study supports that estrogen play an important role in pathogenesis of vitiligo and also progesterone may be associated in the pathogenesis of vitiligo, however, we suggest that study may be conducted in a large number of sample size to reach a conjecture.

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Physico-chemical Analysis and Development of Standards for Kushta Jast (Zinc Calx) Prepared from Modern and Traditional Methods

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Abstract

This study has been undertaken to develop standard manufacturing and operating practice for the preparation and standardization of a Unani herbo-metallic drug called Kushta-e-Jast (Calx of Zinc). It was prepared in the laboratory by traditional method mentioned in the National Formulary of Unani Medicine and by modern technique using digital muffle furnace. The formation of finished Kushta prepared by both the methods was confirmed by organoleptic characters, pH, presence of metallic luster, finger thumb test, and gravimetric analysis. Kushta was also characterized by TLC, scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray diffraction (XRD), atomic absorption spectroscopy (AAS) and inductively coupled plasma atomic emission spectroscopy (ICP-AES). The LD_{50} of Kushta Jast was determined against Albino rats and was found to be 1750 mg/kg body weight. The Kushta contained zinc oxide nanoparticles of different shapes and dimensions.

Key words: Kushta-e-Jast, Nanoparticles, Standardization

Introduction

Kushta is one of the ancient dosage form used in Unani System of Medicine. They are derived from metals, minerals and partly from plants and their extracts. As the metals and minerals cannot be used as therapeutic agents in their original forms they can be used as oxides and/or carbonates. These metal oxides are known as Kushta (Calx) and its method of preparation is known as taklees (calcination) (Tajuddin *et al*., 2015). Kushta is the finest powder form of the medicinal preparations obtained by the calcination of metal, mineral and animal origin drugs. These drugs are calcined in sealed crucibles (buta) in pits of different sizes with varying number and weight of cowdung cakes for heating. During the process of calcination the drugs are detoxified (Umair *et al*., 2015). Because of its very fine particle size which ranges from micro to nano, kushta is easily absorbed in the human body which is highly efficacious and quick in action (Anonymous, 2008). Chemically, kushta may be defined as the calcined product of any desired metal or mineral prepared in a sealed vessel while literally kushta means “to kill” (Sudha *et al*., 2009). This study includes physico-chemical evaluation and development of standard operating procedure of *Kushta-e-Jast* (Calx of Zinc). From clinical viewpoint *Kushta-e-Jast* is used in different body ailments. For instance, it is used in the treatment of gonorrhea and spermatorrhoea (Anonymous, 2006). With all such properties Kushta Jast is yet to be recognized globally because the methods of preparation given in Unani classical literature needs confirmation. There is no standard scientific method of preparation, characterization and authentication of Kushta Jast till date.

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In this study we have prepared the Kushta by traditional as well as modern techniques and tested it by organoleptic characters, pH, presence of metallic luster, finger thumb test, still water test and TLC (Per-coated Silica Gel; 60 F_{254} Merck, Germany) (Rasheed *et al*., 2011 and Tariq *et al*., 2013). They have also been characterized by Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-Ray Diffraction (XRD), Atomic absorption spectroscopy (AAS), Inductively coupled plasma atomic emission spectroscopy (ICP-AES). The LD_{50} of Kushta Jast was also determined against albino rats of either sex.

Table 1: Ingredients of Kushta Jast (Zinc Calx)

Kushta	Ingredients	Botanical /English/ Chemical name	Usage form/part used	Weight
Kushta Jast	Jast	Zinc	Fine powder	10 gm
	Bukun buti	*Lippia nodiflora.*	Whole plant	60 gm

Material and Methods

Procurement of raw material

Zinc granules were purchased from “Merc,k India, Ltd.”. Bukun buti was collected from local area of Sumera, Aligarh. The plant was identified by pharmacognosy section of department of Ilmul Advia, Aligarh Muslim University, Aligarh.

LD_{50} of Kushta Jast

Lethal Dose 50 of Kushta Jast prepared by conventional method was determined on albino rats of both sexes weighing 150 g each by Graphical Method of Miller and Tainter (1944).

Preparation of Kushta by Conventional method:

Zinc granules were powdered and mixed with the bukun buti paste. This mixture was covered with 100 gm cotton and then placed in an earthen disc and sealed by gil-e-hikmat. Now this closed vessel was heated by fire of 10 kg. cow dung cakes. After combustion, the material was ground to fine powder and filtered through 160 no. mesh (Anonymous, 2006). The temperature was monitored regularly by digital pyrometer at an interval of 15 minutes, and a plot of temperature versus time was made.

Modern method:

To prepare Kushta jast by modern technique, the processed drug material was placed in a silica crucible with lid cover and heated in a muffle furnace. The

temperature was maintained at maximum for two hours. Furnace combustion was done in three steps as under.

Ist step: Initial rise in temperature of furnace from 25 to 900°C

IInd step: Maintenance at maximum temperature for next two hours (900°C)

IIIrd step: Self cooling to room temperature (900°C to 25°C in next 3 hours)

The heat quantification graphs were plotted against changes in temperature (Figure 1).

Figure 1: Heat quantification graph of kushta jast

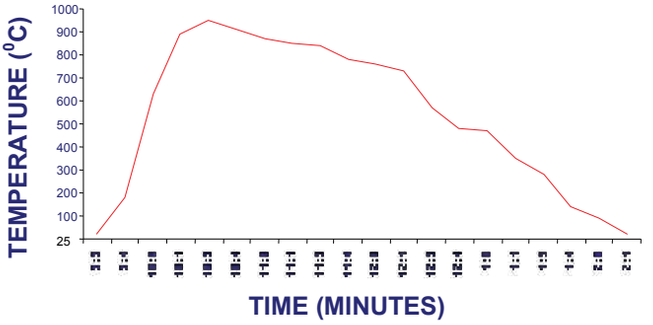


Figure 1 (a): Conventional method

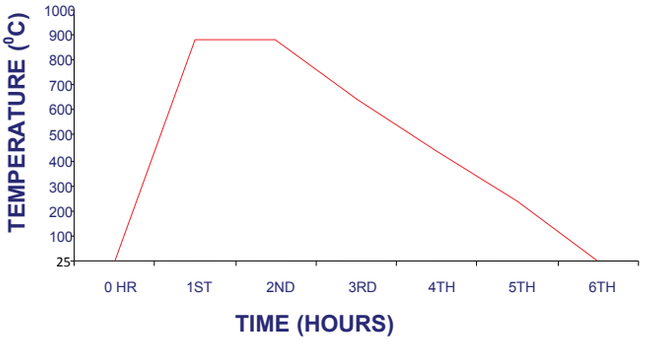


Figure 1 (b): Modern method

Ist step: Initial rise in temperature (25- 900°C in first 55 mins)

IInd step: maintenance of temperature at 900°C for 1 hour.

IIIrd step: slow drop in the temperature (900 to 25°C in last 4 hours)

Results and Discussion

Organoleptic Properties

The Kushta was identified from organoleptic characters. These characters also indicate the status and condition of the drug. If any discoloration appears, it

shows the degradation or decomposition of the formulation (Patel *et al*, 2010, Rahman *et al*., 2015). Organoleptic properties of Kushta Jast, like colour, taste, smell and appearance are depicted in Table 2. These features of kushta were found to be identical for both preparations.

Table 2: Organoleptic characters of kushtajat prepared by modern and conventional methods

Kushta	Colour	Taste	Appearance	Smell
Kushta Jast	Gray	Tasteless	Fine Powder	Odorless

Physico-chemical parameters

From time of collection of raw materials up to the production of medicine, chances of deterioration in quality are quite obvious and it results in decline of the efficacy of drug (Rahman *et al*., 2013). To overcome these problems of Unani drugs it is almost inevitable to standardize the drugs for their rational therapeutic use. Therefore, physico-chemical tests are much basic and very important to standardize the drugs and their formulations (Jahan *et al*., 2008). Loss of weight in drug materials during calcination and presence of metal content in finished kushtajat were checked (Table 3). Thin layer chromatography of Kushta Jast was also done (Figure 5).

A good quality kushta should not contain any metallic luster, must be frictionless when rubbed between finger and thumb (finger-thumb test) and should float on the surface of water (still water test). Kushta Jast successfully qualified these testes. It was found to be neutral in aqueous medium.

Table 3: Physico-chemical parameters of Kushta Jast prepared by modern and conventional methods

Kushta	**Loss of weight (%)**		**Gravimetric metal content (%)**		**Metallic luster**	**Finger thumb test**	**Still Water test**	**pH**	**Solubility in water**
	Conventional method	**Modern method**	**Conventional method**	**Modern method**					
Kushta Jast	10	07	61	62.4	Absent	+ve	+ve	6.9	Soluble

Mobile Phase - Chloroform : Methanol : Acetic Acid (2:5:2)
Spraying reagent - ethanolic solution of Diphenylcarbazone

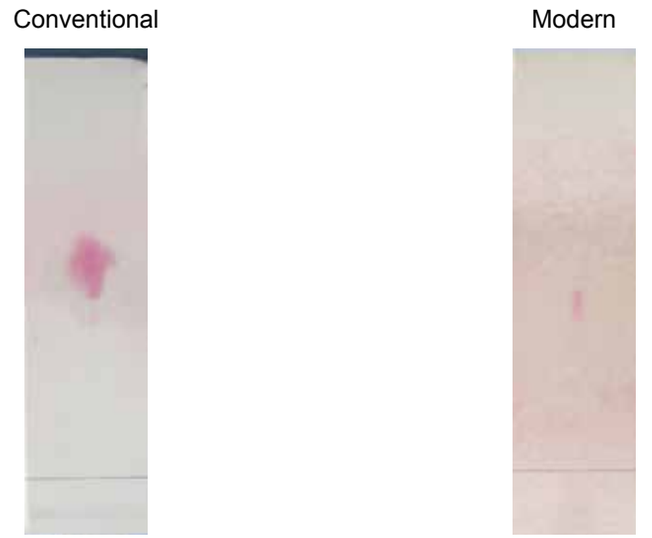


Figure 5: TLC of Kushta Jast

Atomic Absorption Spectroscopic Analysis

The oxygen content and AAS analysis of Kushta Jast shows that the zinc was not completely converted to oxide. Some fraction of it was left in metallic form (Table 4).

Table 4: Atomic Absorption Spectroscopic Analysis

Kushta	Method of preparation	Metal	Total Metal Content		Oxygen Content
			In ppm	In ppm	
Kushta-e-Jast	Conventional	Zn	211550	57.75	2.704
	Modern	Zn	213275	66.375	15.24

Integrated Coupled Plasma Atomic Emission Spectroscopic (ICP-AES)

ICP-AES technique is highly sensitive for the determination of a range of metals and non-metals at concentrations below 10^{-12}. ICP-AES analysis shows that Kushta Jast (Zinc calx) contained Al, Mg and Ca as impurities in larger quantity than those in raw material. It may be due to the mixing of small parts of mud (buta) during heating. The ICP-AES analysis is in agreement with the AAS results (Table 5).

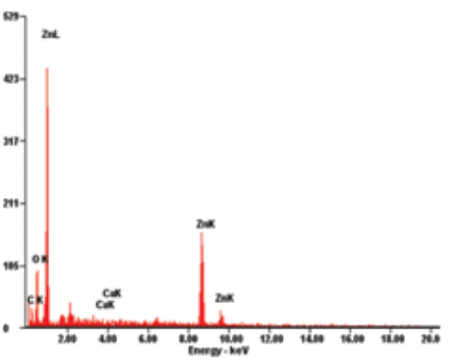
Table 5: ICP-AES of Kushta-e-Jast

Elements Measured	Prepared by Conventional method (In ppm)	Prepared by Modern method (In ppm)	Raw material (In ppm)
Al	259.30	215.77	248.06
As	7.75	BDL	6.59
Ca	4261.63	211.49	335.66
Cd	15.02	15.00	14.44
Cu	338.76	47.03	40.41
Fe	415.41	173.52	168.80
Hg	269.77	227.65	317.64
Mg	584.88	107.40	32.75
Mn	4.36	11.78	1.45
Pb	16.67	41.77	104.65
Sn	36.24	25.61	22.87
Zn	294961.24	280331.06	300678.29

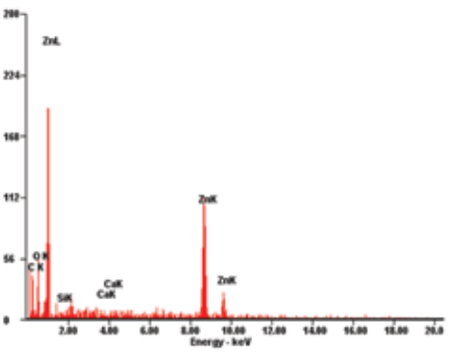
Energy Dispersive X-ray Analysis (EDAX)

EDAX is employed in SEM and TEM for elemental identification and morphology of the particles. The element-specific spectral lines are then identified to give the local elemental composition. EDAX of the Kushta Jast showed all impurities present in it. Some toxic elements have also been detected in trace amounts which are given below in the tabular and graphical form (Figure 6).

Figure 6: EDAX of Kushta Jast



(a) Conventional Method



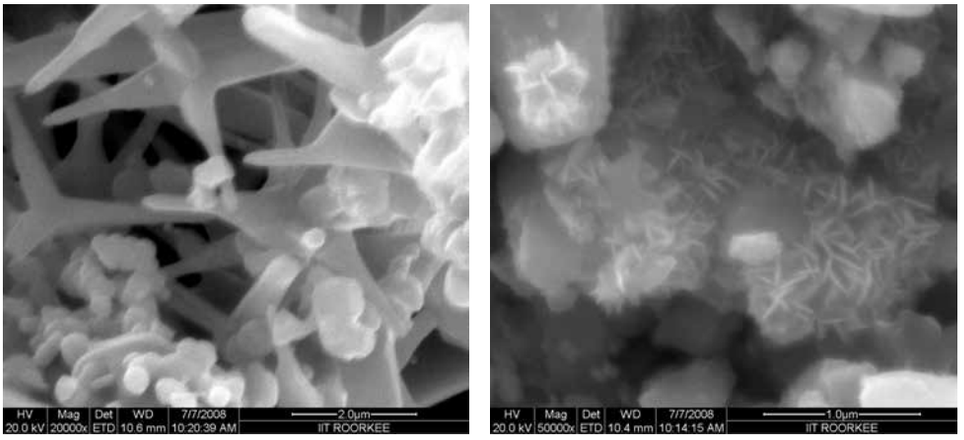
(b) Modern Method

Element	*Wt%*	*At%*
CK	14.47	38.40
OK	13.09	26.08
CaK	00.66	00.52
ZnK	71.79	35.00

Element	*Wt%*	*At%*
CK	18.87	48.67
OK	08.48	16.43
SiK	00.43	00.48
CaK	00.63	00.49
ZnK	73.59	33.94

Scanning Electron Microscopy (SEM) Analysis

It gives the morphology of the substance such as shape, size and arrangement of the particles making an array. The surface of the particles of the Kushta Jast is rough and porous which makes it more soluble and absorbable in living system. It has been observed that micro cracks are developed at the particle boundaries during processing. Comparative SEM images of the kushta are shown in figure 7 . The particles are irregular in shape though needle like and oval p[articles are clearly visible in SEM images.



(a) Conventional Method (b) Modern Method

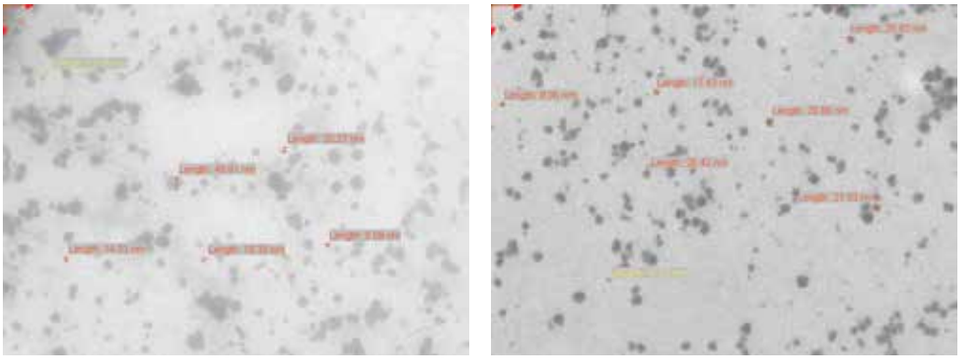
Figure 7: SEM Images of Kushta Jast

Transmission Electron Microscopy (TEM) Analysis

It was observed from the TEM images that the particle size of Kushta Jast, was in the range of nano-scale (Table 6). This clearly indicated the fineness of particles of kushta [Figure 8 (a,b)]. They particle size ranges between 9-48 nm.

Table 6: Particle size of Kushta Jast

Kushta	Method of preparation	Particle size (nanometer)
Kushta-e-Jast	Conventional	9-48
	Modern	9-29



(a) Conventional Method (b) Modern Method

Figure 8: TEM Images of Kushta Jast

Mechanism of absorption

Since zinc oxide (zinc calx) is amphoteric in nature viz., it is soluble in both acidic and alkaline media. It readily dissolves in hydrochloric acid produced in the stomach which can be represented by the following chemical equations.

$$ZnO+2HCL \longrightarrow ZnCl_2 + H_2O$$

$$ZnCl_2 \longrightarrow Zn^{2+} +2Cl$$

The zinc ions thus produced are easily absorbed and any zinc deficiency may thus be supplemented. A dose related to deficiency may be calculated and given to the human being.

Determination of LD_{50} of Kushta-e-Jast prepared by conventional method

It is a technique to measure the short-term poisoning potential (acute toxicity) of a drug. The amount of drug / substance that kills 50% animals of a test group is termed LD_{50} of that drug. The results of LD_{50} of Kushta Jast prepared by conventional method were analyzed (Table 7 and figure 9) by graphical method of Miller and Tainter (1944). Its LD_{50} against albino rates was found to be 1750 mg/kg body weight which means that Kushta Jast is 14 times more tolerable than its prescribed dose. The daily prescribed dose of Kushta Jast for man is 50-125mg.

Table 7: LD_{50} of Kushta-e-Jast (Zinc Calx)

Group	Dose (mg/kg)	Log Dose	Dead/ Total	Dead %	Corrected %*	Probit
1	1000	3.00	0/6	0	4.2	3.25
2	1250	3.09	1/6	16.7	16.7	4.05
3	1500	3.17	2/6	33.3	33.3	4.56
4	1750	3.24	9/6	50	50	5.00
5	2000	3.30	4/6	66.7	66.7	5.44
6	3000	3.47	6/6	100	95.8	6.75

* Corrected formula: for the 0% dead: 100 (0.25/n); for the 100% dead: 100[(n-0.25)/n], where n is the number of animals in the group.

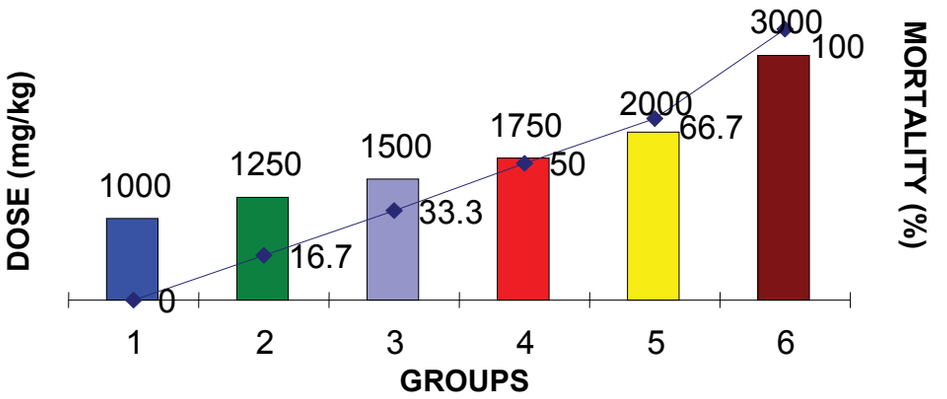


Figure 9: LD50 of Kushta Jast

Conclusion

It may be concluded that Kushta Jast (Zinc Calx) is a mixture of zinc and zinc oxide. The solubility varies with pH of the solution. It is known that pH in the stomach falls between 2-5, where it is easily dissolved and absorbed. However, it was found that the modern method is superior to conventional method because, the Kushta prepared by this technique gives smaller particles. Kushta Jast prepared by both the conventional and modern method exhibit the same chemical and physical properties. It was also observed that the Kushta Jast is in nanoparticluate form of their oxides although there is a distinct difference in particle size. Kushta may be prepared by both the methods but the change in temperature with time should be strictly followed.

These parameters of standardization can also be used as reference for making a good quality kushta.

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Evaluation of Anti-inflammatory and Analgesic Effect of Moghas (Stem Bark of *Litsea glutinosa*) in Albino Rats

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Abstract

Anti-inflammatory and analgesic activity of a Unani drug "Moghas" identified as stem bark of *Litsea glutinosa* (Lour.) C.B. Rob. of family Lauraceae was investigated, as this drug has been in use since long to treat various inflammatory disorders including rheumatoid arthritis and gouty joints etc. The powdered stem bark of *Litsea glutinosa* was extracted in ethanol and distilled water separately and dried. The dried extract was used to study anti-inflammatory and analgesic effect, using formalin induced paw oedema test and analgesiometer on tail flick test, respectively in albino rats. The aqueous and alcoholic extracts of test drug were used in low doses (90 mg/kg and 100 mg/kg respectively) and high doses (130 mg/kg and 140 mg/kg, respectively). The animals were divided into six groups of six rats each; piroxicam 3 mg / kg (orally) was used as standard drug. The data expressed as Mean± SEM were analyzed by ANOVA followed by Dunnett's "t" test. The aqueous and alcoholic extracts of Moghas at high doses exhibited significant ($P< 0.01$) anti-inflammatory activity in formalin induced model as compared to control group. The aqueous extract of test drug at high dose and alcoholic extract in both doses exhibited a significant increase in the reaction time ($P< 0.01$) indicating analgesic activity. The findings therefore demonstrated that the test drug possesses significant anti-inflammatory and analgesic activities.

Keywords: Moghas, *Litsea glutinosa*, Antiinflammatory, Analgesic

Introduction

Moghas (in Indian market known as Maida lakdi) is the stem bark of *Litsea glutinosa* (Lour.) C.B. Rob. of family Lauraceae. It is a well known Unani drug being used since centuries to treat inflammatory disorders like rheumatoid arthritis, gout, sciatica, backache, joint stiffness etc.(Ibn Sina, 1927; Ghani, 1921; Kabeeruddin, 1955; Daljeet, 1974; Azam Khan, 1987). It has also been described to be used for dressing in wound and internally to check the dysentery and diarrhoea. It is an ever green shrub or tree found throughout India, ascending up to an altitude of 1350 meter in the outer Himalayas, especially in Bengal and in the hills of South India (Anonymous, 1962; Satyavati and Gupta, 1987; Nadkarni, 1989).

The presence of Laurotetanine, actinodaphnine, their N-methyl derivatives, boldine and norboldine have been reported in the stem bark, whereas flavonoid narigerin, glucosides, quercetin and its 3-rhamnosides have been detected from its leaves. Mandal *et al*. (2000) studied that methanolic extract of bark contains antibacterial activity which was comparable with Chloramphenicol.

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Menon *et al*. (1970) reported that essential oil of *L. glutinosa* introduced analgesia in rats and also showed anthelminthic activity against earthworms and tapeworms. Although Maida Lakdi has been described in Unani Medicine to be effective clinically in inflammatory disorders but no scientific study is available to support the claims, therefore the present study was undertaken to investigate its anti-inflammatory and analgesic potentials.

Materials and Methods

The study was carried out during the year 2007-2008 at Hamdard University New Delhi. Maida Lakdi was procured from Taj Trading Company, 6682, Khari Bawli, Delhi in July 2007. The drug was initially identified on the basis of description mentioned in Unani literatures which was further authenticated by the National Institute of Science Communication And Information Resources (NISCAIR), New Delhi. A voucher specimen (06/765/82) has been deposited in the Mawalid Salasa Museum of Department of Ilmul Advia, Hamdard University New Delhi.

Stem Bark of *Litsea glutinosa* (Maida lakdi)

Preparation of Alcoholic and Aqueous Extracts

The powder dried stem bark (400 gm) of Maida Lakdi was extracted by refluxing with alcohol for 6 hours and filtered extract was evaporated on a water bath to get viscous alcoholic extract (56.5 gm/14%), whereas to obtain aqueous extract, the course powder (200 gm) was boiled with 2000 ml of distilled water for one hour. It was then filtered and the filtrate material was evaporated on a water bath to get a mucilaginous viscous aqueous extract (26.5 gm/13%).

Experimental Animals

Wistar albino rats weighing 150-200 gm of 12 weeks of either sex, supplied by the Central Animal House Facility, Hamdard University New Delhi were used in

this study. The animals were housed in groups of polyacrylic cages (38×23×10 cm) and maintained under standard laboratory conditions. They were allowed free access to standard dry pellet diet and water ad libitum. The experiments were performed in accordance with the guidelines for the care and use of laboratory animals, laid down by CPCSEA.

Test for Anti-inflammatory Activity

Formalin-induced rat paw oedema test

The test was carried out to determine the anti-inflammatory effect of test drug by the method of Hunskaar and Hole (1987). Animals were divided in to 6 groups of 6 rats each and treated orally. Animals in Group I and II were treated with normal saline (1ml/rat) and Piroxicam (3 mg/kg) and served as plain and standard control, respectively. Aqueous extract (90 and 130 mg /kg and alcoholic extract (100 and 140 mg /kg), were given to Group III,IV,V and VI respectively. One hour later 50 µl of 2.5% formalin solution in normal saline was administered subcutaneously in the sub planter aponeurosis of left hind paw of the rat to produce inflammation and the paw volume was measured using plethysmometer at 0, 1, 2, 3, 4 and 5 hours by the method of Sertee *et al* (1988). The findings expressed as Mean±SEM were analysed by ANOVA followed by Dunnett's "t" test.

Test for Analgesic Activity

To determine the analgesic activity of Moghas extract, the method described by Amour and Smith (1941) and Ahmadiani *et al* (2000) was used. Albino rats were divided in to 6 groups of rats each and treated in similar way as in previous test. After the treatment all the animals were placed on the hot plate and the reaction time for the animals to lick the paw or jump from the hot plate was taken as latency(s). It was observed at 30, 60, 90, 120 and 150 minutes from the time of treatment. The temperature of the hot plate was maintained at 55± 2◦C.

Table 1: Effect of Aqueous and Alcoholic Extract of Moghas (*Litsea glutinosa*) on formalin induced paw oedema in rat

Groups	Treatment	Time after treatment					
		0 hr.	**After 1 hr.**	**After 2 hr.**	**After 3 hr.**	**After 4 hr.**	**After 5 hr.**
I	Control	0.78±0.09	1.38±0.07	1.46±0.07	1.6±0.05	1.66±0.06	1.65±0.09
II	Standard control (Piroxicam) 3mg/kg	0.71±0.08	0.91±0.03** 34.05%	0.96±0.04** 34.24%	0.98±0.04** 38.75%	1.01±0.03** 39.15%	1.01±0.04** 38.78%
III	Tets drug (Aq. Ext. 90 mg/kg)	0.78±0.05	1.25±0.06## 9.42%	1.43±0.05## 2.05%	1.45±0.05## 9.3%	1.43±0.11## 13.85%	1.55±0.14## 6.06%
IV	Test drug (Aq. Ext. 130 mg/kg)	0.8±0.03	1.21±0.08# 12.31%	1.38±0.07## 5.47%	1.55±0.06## 3.12%	1.46±0.06## 12.04%	1.43±0.13# 13.33%
V	Test drug (Alc. Ext. 100 mg/kg)	0.9±0.08	1.1±0.07* 20.28%	1.1±0.03** 24.65%	1.28±0.03**## 20.%	1.25±0.03** 24.69%	1.21±0.07** 26.66%
VI	Test drug (Alc. Ext. 140 mg/kg)	0.85±0.04	1.06±0.05** 23.18%	1.13±0.05** 22.6%	1.18±0.03**# 26.5%	1.16±0.03** 30.12%	1.13±0.04** 31.51%

*P<0.05 and **P<0.01 as compared to group Ist (control group)

#P<0.05 and ## P<0.01 as compared to group IInd (standard group)

Table 2: Effect of Aqueous and Alcoholic Extract of Moghas (Litsea glutinosa) against thermal stimuli in rats

Treatment	Time after treatment				
	Initial reaction time	**30 min.**	**60 min.**	**90 min.**	**120 min.**
control	3.9±1.57	4.12±0.61	4.98±0.79	3.69±1.24	3.57±0.76
Standard(Piroxicam 3mg/kg)	4.77±0.46	6.14±0.70*	6.44±0.82**	6.36±0.50**	6.31±0.47**
Tets drug (Aq. Ext. 90 mg/kg)	3.94±0.39	5.49±1.04	4.49±0.78	4.27±0.38	4.88±1.34
Test drug (Aq. Ext. 130 mg/kg)	4.13±0.63	4.96±1.0	5.38±0.85*	5.78±0.42**	4.89±0.78
Test drug (Alc. Ext. 100 mg/kg)	3.29±0.86	4.43±1.73	5.94±1.29*	5.64±1.57*	3.84±1.58
Test drug (Alc. Ext. 140 mg/kg)	3.78±0.84	4.79±1.44	6.35±1.13**	6.43±1.08**	6.16±0.68**

*P<0.05,**P<0.01 as compared to pre drug reaction time

Results

Anti-inflammatory Activity:

The reduction in the volume of paw oedema was observed at different doses of aqueous and alcoholic extracts. The two doses of alcoholic extract exhibited significant ($P<0.01$) anti-inflammatory activity at 1, 2, 3, 4, and 5th hours, but it was found less than standard drug. The maximum inhibition of inflammation was found at 2, 4, and 5th hours in low dose of alcoholic extract whereas the maximum effect was produced at the high dose at 4th and 5th hours. In case of aqueous extract both at low and high doses, the drug did not produced significant inhibition in paw oedema during the duration of study (Table 01).

Analgesic Activity:

The extract of Maida lakdi at different doses induced a significant ($P<0.01$) increase in the tail flick latency when compared with control group. A significant increase in reaction time of tail flick latency was observed at 30 minutes in lower dose of aqueous extract whereas it was found significant at 60 and 90 minutes in higher dose. A significant result was exhibited at 60 and 90 minutes in low dose of alcoholic extract, while in higher dose it was found significant ($P<0.01$) statistically at 60, 90 and 120 minutes (Table 02).

Discussion

The study demonstrated that the alcoholic and aqueous extracts of test drug possess significant analgesic activity, while the alcoholic extract was found to produce significant anti inflammatory effect. Since Maida Lakdi has not been investigated so far for anti-inflammatory and analgesic activity, therefore the present study assumes significance because it produced one of the earliest reports regarding its analgesic and anti-inflammatory effect. The alcoholic extract of stem bark of test drug at low and high doses showed marked anti-inflammatory effect on formalin induced paw oedema in albino rats; however maximum effect was produced at 2nd, 4th and 5th hours indicating that its effect starts a bit late but continues for several hours. The aqueous extract at low and high dose on the other hand did not produce significant anti inflammatory effect. The findings suggested that the test drug contains some of the alcohol soluble constituents that are actually responsible to induce the anti inflammatory activity. The study warrants therefore that elaborate phytochemical studies should be carried out for the characterization of the active constituents.

As reported by Ahmadiani *et al*. (2000), formalin induced inflammation model is an important test for anti-inflammatory agents acting by inhibiting the mediators of inflammation therefore the results of present study indicate that stem bark of

Litsea glutinosa may be effective in inflammatory disorders because of interfering some of the mediators probably one which may be responsible for delayed phase of anti-inflammatory response (Nafees *et al*., 2015).

The analgesic activity of stem bark of *Litsea glutinosa* extract was also assessed by using hot plate. The result has shown that both aqueous and alcoholic extracts produced significant analgesic effect. The alcoholic extract of test drug at high dose (140 mg/kg.) showed a significant increase in reaction at 60, 90, and 120 minutes ($P<0.01$). The effect was found to be dose dependant suggesting that it may be used for various degree of analgesia in case of different types of acute and chronic ailments. Since the drug was found to be effective against thermal stimuli therefore it is likely to possess opioid type of analgesia. Thus the study validated its practice as an analgesic and anti-inflammatory agent in the treatment of different inflammatory and painful conditions.

Conclusion

Based on the findings it was concluded that Unani drug Moghas (stem bark of *Litsea glutinosa*) possesses significant analgesic and anti-inflammatory effect and may be used therapeutically in a number of pain related problems. Further it may also be used in inflammatory conditions particularly in chronic inflammatory diseases as its alcoholic extract was found to be effective in delayed phase of inflammatory response.

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Development of Standard Operating Procedures for the Preparation of Sharbat Aloo Baloo

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Abstract

A vast literature related to the drug formulations of Unani system of medicine (USM) is available in various *Qarabadeen* (pharmacopoeia) such as *Qarabadeene Kabeer, Qarabadeene Qadri* and *Qarabadeene Azam*. But the operating procedures have not been described objectively in respect of several preparations. Therefore, preparation and storage of many drugs and prediction about magnitude of their pharmacological effect become difficult. *Sharbat*, is an important and commonly used dosage form. If it is prepared at different degree of temperature, chances of variability in its characteristics and pharmacological actions may persist. Degree and duration of heat, ratio of water and drug, ratio of preservative etc are considered important to prepare the standard *qiwam* of *Sharbat*. In present study, different batches of *Sharbat Aloo Baloo* (SAB) have been prepared to develop the SOP. Different batches were prepared in different volumes (one liter, five liters and ten liters) at different degree of temperature. The duration of application of heat and the net volume of the product left after the completion of procedure were measured. The findings may be used as the indicator of SOP for *Sharbat Aloo Baloo*.

Keywords: Unani System of Medicine, Standard operating procedures (SOPs), *Sharbat Aloo Baloo, Sharbat*.

Introduction

Different dosage forms of compound preparations are used in Unani medicine. Therefore the preparation methodologies of different classes of dosage forms are different. Although the methods of preparation of different dosage forms are given in many classical books, but the description is occasionally too short and unintelligible to understand the whole procedure. Earlier dosage forms were prepared mostly by expert *Hakeems or Attars* on small scale to get over the local needs whereas now-a-days industrial pharmacy is commonly practiced to prepare the drugs in bulk. It requires objectivity and precision of operating procedure so that drugs of uniform quality can be produced. It is being observed that same formulation prepared by different companies differs in their physicochemical constants. This happens mostly because same operating procedures are not followed by the different pharmaceutical units.

Sharbat Aaloo Baloo (SAB) is an important pharmacopoeal preparation used in the treatment of various ailments of urinary system mainly for its diuretic and lithotriptic activities (Kabeeruddin, 2010; Khan, 1996; Ahsan, 2006). However the samples available in the market are grossly different from each other because the manufacturers are not following standard operating procedure to prepare

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them. Further, they use the same method for preparing different volumes of the product. Therefore in the present study, different batches of SAB were prepared in different volumes (one, five and ten liters) at specific temperature [MT-LB (Maximum temperature on large burner] (table 1) and observed the duration of heating and net volume of product left after giving suitable temperature along with the concentration of sugar in it.

Materials and Methods

Procurement and identification of raw drugs and excipients

All the ingredients mentioned in the table 2 (Kabeeruddin, 2010; Khan, 1996; Anonymous, 2006; Said, 1997; Hafeez, 2005), were procured from the market of Bengaluru. *Aloo baloo* was identified by Botanist S. Noorunnisa Begum, Senior Assistant Professor, Centre for Repository of Medicinal Resources (C-RMR), Trans Disciplinary University (TDU), Bengaluru. The specimen was preserved in the Repository of Medical Resources Herbarium with accession number Aalubaalu – 3819 at NIUM, Bengaluru.

Preparation of different batches (1, 5 and 10 litres) of *Sharbat Aloo baloo*

Different batches of SAB (one, five and ten litres) were prepared by taking the decoction of *Aloo baloo* and sugar in the ratio of (drug and sugar ratio) 1:4 and heating it at MT-LB (Maximum temperature on large burner, 670-680 °C). Total duration of heating in different batches was observed.

Preparation of *Sharbat Aloo baloo*

Fruits of *Aloo baloo* were soaked in water for overnight in a stainless steel pot. In the morning it was boiled on a stove till the pulp softened and the volume of water reduced to half. It was then filtered with a fine cloth to get the decoction. The decoction was taken in stainless steel pot; sugar and citric acid (2 gm/kg of sugar) were mixed with it. It was then heated on a gas stove with continuous stirring to prepare the *qiwam* of sharbat. Benzoic acid (1gm/kg of sugar) was then added after dissolving it in sterilized hot water. The content was further heated for one minute and allowed to cool thereafter.

In-process standardization

The *qiwam* was tested on classical parameters and also by hand refractometer to determine the concentration of sugar. The external temperature was monitored regularly to protect the product from getting viscous and getting the sugar crystallized subsequently (Kabeeruddin, 2010). The total time consumed (duration of total heating) in the preparation of *qiwam* of *Sharbat* was also measured.

Similarly the internal temperature was also noted. At the end the net yield product was also measured.

Table 1: Heating capacity of different size gas stove burner

Small gas stove burner (6.5 cm diameter × 0.5 cm thickness)			Large gas stove burner (7.5 cm diameter × 0.5 cm thickness)		
Slow heat (by TC in°C)	**Moderate heat (by TC in°C)**	**Maximum heat (by TC in°C)**	**Slow heat (by TC in°C)**	**Moderate heat (by TC in°C)**	**Maximum heat (by TC in°C)**
480 to 490	570 to 580	600 to 610	500 to 510	600 to 610	670 to 680

TC= Thermocouple

Table 2: Ingredients of SAB

S.No.	Unani name	Scientific name	Part used	Quantity
1.	*Aloobaloo*	*Prunus cerasus*	fruits	1part
2.	Sugar	Sucrose	___	4parts
3.	*Satt-e-lemu*	Citric acid	___	2% of sugar
4.	*Natroon banjawi*	Sodium benzoate	___	1% of sugar

Table 3: Vessels used in the preparation of SAB

S.No.	Metal	Capacity	Weight	Used for making
1.	Stainless steel	2lt	285gm	One lt *Sharbat*
2.	Stainless steel	10lt	1570gm	Five lt *Sharbat*
3.	Stainless steel	15lt	2068gm	Ten lt *Sharbat*

Results and Discussion

Efficacy of any drug formulation mainly depends on the quality/purity of its ingredients and the manufacturing process followed, to prepare the specific dosage form. If any of the two factors are anyhow compromised then the drug will not have the desired attribute for which it is intended to be used in a disease. Data are available in Unani pharmacopoeia to check the quality and standards of a drug. Although the Standard Manufacturing Process (SMP) of various dosage forms is available, but the procedures have not been described objectively so as to prepare the drugs with specification. For example the time required for soaking or boiling the drug, degree of temperature and the exact quantity of binders and excipients etc have not been mentioned. Difference in these components may lead to substandard preparation (Lachman, 2013). SOP_s of preparation of SAB in three different volumes (one, five and ten litres) were developed because it is prepared in different volumes as per requirement of a physician and the market.

To set the standard operating procedure of SAB, three batches (of one, five and ten litres) were prepared. These were prepared as per the description given in *Bayaz Kabeer*.

SOP for the preparation of one litre of SAB: 200 gm of fruits of *Aloo baloo* was soaked in 800 ml of water in the ratio of 1:4 (drug and water) for overnight in an stainless steel pot (Table 2). In the morning it was boiled at MT-SB (Moderate temperature on small burner {570-580 ºC}) (Table 1), till the pulp softened and volume reduced to half. Thus 400 ml of decoction was obtained. Decoction was prepared after 20 minutes of heating. Thereafter the decoction was taken in a stainless steel pot and 800 gm of sugar (drug and sugar ratio of 1:4) was added. 1.6 gm of citric acid (2 gm/kg of sugar) (Said, 1997) was also added and the mixture was then heated on MT-LB with continuous string to bring the *qiwam* of *Sharbat* (one *tar*). *Qiwam* was prepared only in 4 minutes. It was checked by classical parameter (by placing a drop in between thumb and finger, by spoon, by putting a drop at a dry place (Anonymous, 2006, Kabeeruddin, 2010). After preparation of *qiwam*, 0.8 gm of benzoic acid (Said, 1997) was added after dissolving it in sterilized hot water. The content was further heated for one minute. Total 930 ml of *Sharbat* was obtained by this method. Refractive index was found to be 67%.

SOP for the preparation of five litres of SAB: 1000 gm of fruits of *Aloo baloo* was first soaked in 4000 ml of water for overnight in the stainless steel pot, boiled in the morning at MT-SB (Moderate temperature on small burner {570-580 ºC}) (Table 1), till the pulp softened and volume reduced to half (2000 ml of decoction). 2000 ml of decoction was obtained after approximately 70 min of heating. The decoction was taken in stainless steel pot and 4000 gm of sugar was added to it. 8 gm of citric acid in the ratio of 2 gm/kg of sugar (Said, 1997) was also added and the mixture was then heated on MT-LB with continuous string to bring the *qiwam* of *Sharbat* (one *tar*). *Sharbat* was prepared in 12 minutes. It was checked by classical and modern parameters for consistency. After preparation of *Sharbat qiwam*, 4 gm of benzoic acid in the ratio of 1 gm/kg sugar (Said, 1997) was added after dissolving it in sterilized hot water. The content was further heated for one minute. Total 4700 ml of *Sharbat* was obtained by this method. Refractive index was found to be 67%.

SOP for the preparation of ten litres of SAB: 2000 gm of fruits of *Aloo baloo* was soaked in 8000 ml of water for overnight and boiled as in previous preparations to get 4000 ml of decoction, obtained after approximately 120 min of heating. 8000 gm of sugar was added to the decoction. 16 gm of citric acid in the ratio of 2 gm/kg of sugar (Said, 1997) was also added and the mixture was then heated on MT-LB with continuous string to prepare the *qiwam* of one *tar*. *Qiwam* was prepared in 18 minutes. The consistency of quiwam was determined as in previous two cases. After preparation of *Sharbat* 8 gm of benzoic acid dissolved in hot water was added to it. The content was further heated for one minute. Total 9300 ml of *Sharbat* was obtained by this method. Refractive index was found to be 67%.

The yield volume of syrup in all three preparations was found to be the same in terms of percentage. Similarly, the refractive index was also found to be the same indicating that the procedure adopted to prepare Sharbat *Aloo baloo* is appropriate and reproducible. Further, the procedure is equally effective for both small and large scale production. The operating procedures used for the preparation of *Sharbat Aloo baloo* appears to be suitable and can be taken as standard.

Conclusion

Operating procedure for the preparation of SAB in different volumes (one, five and ten litre) used in the study is comprehensive and reproducible therefore it may be taken as Standard Operating Procedure for this pharmacopoeal preparation.

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Role of Temperament (Mizaj) and Humours (Akhlat) in Determining the Phenotype – Validation of the Theory by Correlation with Laboratory Parameters in Healthy Subjects

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Abstract

Temperament is the most significant factor in health, diesease, diagnosis and treatment in Unani System of Medicine. The dominant forms of Sanguine, Phlegmatic, Bilious and Melancholic temperament were evaluated in healthy volunteers in consonance with Unani Principles. The objective of the study was to apply laboratory methods in the studies of fundamental research for a better understanding of the concept and to rationalize the concepts of Unani system of medicine as well as to validate the theories of fundamental research in the light of physiological and biochemical parameters; thereby correlating the theory of fundamental research with modern biology. The study was conducted during the period 1985 – 1995.

An effort has been made to correlate clinical, physiological and biochmeical parameters with various temperament. Some parameters correlated with the Unani principles while a few could not be correlated or rationalized.

Key words: Temperament, Kulliyat, Principles of Unani System of Medicines, Humours, Biochemical parameters, Haematological parameters, Physiological parameters.

Introduction

Hippocrates – "The Father of Medicine" is a symbol of the first creative period of medicine and to a certain extent his name has come to represent the beauty – value and dignity of medicine of all times (Leslie, 1976).

Every system of medicine is based on a definite concept of man. Infact, he was never isolated from nature – he has truly turned as microcosm with nature being the macrocosm. Therefore, it is argued that when the human body is really a microcosm then it should be a manifestation of all cosmological forces or energies and should possess all the elements that are present in the macrocosm. Therefore, Unani Physicians have envisaged in cosmic man the existence of four elements and four qualities which is nothing but a condensed version of the world (Hameed *et al*., 1987).

The fundamental framework of this system is based on deep philosophical insights and scientific principles, including the Empedoclean theory of four elements i.e. Air, Water, Fire and Earth; Four proximate qualities (Kayfiyat) i.e. Hot, cold, Wet and Dry described by Phythagoras, and the Hippocratic theory of four Humours (Akhlath) Blood (Dam), Phlegm (Balgham), Yellow Bile (Safra) and Black Bile (Sauda). Admixture of different elements and their qualities in specific ratio in a particular entity, whether living or non-living, denominates its Temperament

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(Mizaj). Human temperament is commonly denoted by the dominant humour i.e. Sanguine (Damvi), Phlegmatic (Balghami), Choleric (Safravi) and Melancholic (Saudavi). The human temperament can be correlated with the temperament of Diet, Drugs, Environmental factors etc. as the entities of non-human Universe being made up directly of elements are described in terms of Qualitative temperament (Azmi, 1995; Nafis, 1935; Sina, 1930).

The Hippocratic doctrine which was later accepted and developed by the Arabs took its firm roots in India and now continues to be one of the foremost sectors of Indian health care – by the name Unani Medicine. This doctrine regards the body as formed of four elements; air, earth, water and fire, which unite in the composition of the single parts of the organism. Then as each of these four elements possesses its particular quality – cold, hot, dry and wet – the single parts of the organism also possesses their essential qualities (Leslie, 1976; Azmi, 1995; Nafis, 1935; Sina, 1930).

The Unani System of Medicine – is a holistic system of medicine and does not confine to reductionistic or molecular approach but refers to knowledge as a total recognition of the person presented to the physician. The Pythagorean qualities refer to the living beings and the human body is materially represented by four elements earth, water air and fire. Earth represents the solids, water – the fluids, air-the gases and fire – the heat of the body. They are natural entities and they also represents four principles of motion i.e., fluidity, solidity, gas and heat as the source of motion (Leslie, 1976; Azmi, 1995; Hameed *et al*., 1987; Ali *et al*., 1983).

Theory of Akhlath is a backbone of diagnosis and therapeutics in Unani system of medicine. The research activity on humours was undertaken to develop the Unani system of medicine in consonance with the principles of the system. The research activity on humors was undertaken to develop the Unani system in consonance with the basic philosophy of the system. The project on humors has been making concerted efforts to provide modern scientific correlation basis to this age old system. Hence, as a preliminary step pattern of different clinical, biochemical, physiological parameters among healthy individuals having Damavi (Sanguine), Balghami (Phlegmatic), Safravi (Bilious) and Saudavi (Melancholic) temperaments was studied.

Materials and Methods

Subjects

Four Hundred and Fifty Two (452) normal healthy adults of either sex in the age group of 25-55 years formed the subjects of the study. Their consent was taken prior to their inclusion in the study – and also the health status of individual subjects was assessed to exclude any type of disease. If the individual was

found to be perfectly healthy on clinical assessment by Unani physicians then only they have been included in the study and were enrolled for the study.

Assessment of Dominant Temperament

On registration at the Akhlath unit (Fundamental Research Unit) the assessment of the temperament was done by a panel of three senior Hakeems wherein all the physiological systems of the body which help in the maintenance of bodily homeostasis were taken into consideration. The volunteers were clinically examined – their clinical histories, physiognomy, (concerning all the systems – as well as the co-ordinating systems) were analyzed, along with social, psychological behavior, habits, physical fitness as per protocol parameters. A scoring system was adopted to quantify the objective parameters.

Apart from clinical examination, emphasis was also laid on the naked eye examination of urine (Baul) and stool (Baraz). The most valuable and essential aspect of clinical assessment was the examination of pulse (nabz) by 3 senior Hakeems – where 10 features of Nabz (pulse), e.g. strength, softness, amplitude, regularity etc were taken into consideration which formed an important tool for determination of the dominant khilt (Human) in a subject. The information obtained was recorded in a specially designed Case Report Form (CRF). It was designed by Late Iqbal Ali Khan, Director, CRIUM and approved by the then Scientific Advisory Committee, CCRUM).

The temperament was determined by the analysis of the recorded parameters as well as by the subjective judgement of senior Unani physicians.

This master chart is based on the concept as given in the Unani Classical literature and initially developed by a group of eminent physicians the document developed. After the determination of the temperament, the subjects were subjected to biochemical and physiological as well as applied physiological investigations.

The parameters of laboratory investigations included:

(i) Biochemical parameters

The biochemical parameters studied included the following:

- Blood sugar.
- Liver function tests.
- Plasma proteins.
- Blood urea.
- Serum Creatinine
- Serum cholesterol.

- Na+ and K+ ions.
- Serum iron.
- Hormone – Insulin
- Hormone – Thyroid hormones (T3,T4 and TSH)

(ii) Physiological parameters

The physiological parameters included the following:

Haematological parameters

- Hemoglobin %
- R.B.C.
- W.B.C. – DC
- ESR
- Viscosity of Blood
- Urine and Stool analysis

Applied physiological parameters

- Determination of Basal metabolic rate
- Lung Function Tests (e.g. Tidal volume, Minute volume etc)
- Bicycle ergometry (e.g. Work output etc.)
- Electrocardiography
- Anthropometric measurements
- Hand grip test
- pH of Sweat and Saliva

Every single case report form (CRF's) was re-examined, cross checked and audited.

For investigation and inference of biochemical and physiological parameter we have followed:

Biochemical Investigations: Conn *et al*., 1987; Lehninger, 1982; Orten *et al*., 1982; West, 1985.

Physiological Investigations: Chatterjee, 1980; West, 1985; Ganong, 1989; Keele and Neil, 1971; Chaudhry, 2016.

Statistical design and Analysis of Results

The data were subjected to statistical analysis in order to find out whether there is any significant correlation of biochemical and physiological parameters with each dominant temperament.

Observations

The results have been presented in tabular form (Tables 1-9).

All the results are within the normal physiological limits as these are the cases of healthy volunteers. An endeavor has been made to find out whether there are any statistically alterations in between the four dominant temperaments in respect of laboratory parameters.

Table 1: Temperament wise classification of healthy volunteers

Temperament	No. of Cases
Damavi	150
Balgami	154
Safravi	102
Saudavi	46
Total	452

Table 2: Age and sex wise distribution of Damavi, Balghami, Safravi & Saudavi healthy volunteers

Sex Temperament Age Group in years	Male					Female				
	Damavi	Balghami	Saudavi	Safravi	Total	Damavi	Balghami	Safravi	Saudavi	Total
20 – 30 years	34	17	16	34	101	21	39	13	08	81
30 – 40 years	43	33	09	33	118	19	41	12	05	77
40 – 50 years	27	16	04	07	54	03	07	01	03	14
Above 50 years	03	--	02	02	06	--	01	--	--	01
Total	107	66	30	76	279	43	88	26	16	173

Table 2A: Physiological investigation of healthy volunteers (Mean + Standard deviation)

Temperament	Height cm.	Weight Kg.	Body Mass Index Kg./m2	Blood Pressure mm/Hg
Damavi (150)	165 + 13	68 + 5.58	26.9	115 + 8 / 78 + 12
Balghami (154)	155 + 7	71 + 3.96	31.6	107 + 10/ 72 + 5
Safravi (102)	168 + 10	62 + 7.82	24.2	118 + 6 / 76 + 5
Saudavi (46)	162 + 12	61 + 5.31	23.8	124 + 11 / 68 + 6

Table 3: Quantitative and qualitative temperament (Mean + Standard deviation) of healthy volunteers

Temperament	Quantitative				Qualitative			
	Damavi	Balghami	Safravi	Saudavi	Hot	Cold	Wet	Dry
Damavi	8.42 ± 2.32	4.59 ± 2.20	3.99 ± 2.10	1.88 ± 1.59	8.02 ± 2.94	4.29 ± 2.33	3.36 ± 1.59	2.48 ± 1.84
Balghami	5.31 ± 2.11	9.06 ± 1.86	4.42 ± 2.3	2.53 ± 1.61	6.65 ± 2.36	7.13 ± 2.61	5.52 ± 2.36	3.29 ± 2.11
Safravi	5.11 ± 1.72	4.45 ± 2.22	7.80 ± 1.81	2.87 ± 3.53	8.58 ± 2.93	4.01 ± 2.22	3.04 ± 2.02	4.20 ± 2.22
Saudavi	3.56 ± 1.7	3.63 ± 2.24	3.45 ± 1.49	8.06 ± 2.24	5.80 ± 2.03	5.17 ± 2.37	2.84 ± 1.70	5.63 ± 2.65

Table 4: Biochemical investigations (Mean ± Standard deviation) of healthy volunteers

Temperament	Blood Viscosity	Blood Sugar (ugs)	Blood Urea (wgs)	Blood cholesterol (mgs)	Total protein (gms)	Albumin (gms)	Globulin (gms)	Serum Bilirubin (mgs)	S.G.P.T.1 Unit
Damavi	4.35 ± 0.98	78.66 ± 14.0	24.37 ± 8.7	197.17 ±52.7	6.54 ±0.61	3.47 ±0.24	3.09 ±0.37	0.65 ±0.24	17.02 ±10.29
Balghami	4.25 ± 0.87	83.43 ± 19.7	23.46 ± 9.9	223.33 ±57.3	6.52 ±.025	3.37 ±0.25	3.15 ±0.25	0.73 ±0.11	15.04 ±8.19
Safravi	4.22 ± 0.71	80.12 ± 16.1	25.72 ± 9.8	186.99 ±57.3	6.65 ±0.30	3.43 ±0.4	3.18 ±0.20	0.64 ±0.30	14.92 ±8.12
Saudavi	4.63 ± 1.36	82.54 ± 19.7	29.67 ± 9.8	193.88 ±51.8	6.58 ±0.54	3.44 ±0.54	3.12 ±0.27	0.66 ±0.34	16.74 ±8.75

Table 5: Biochemical Investigations (Mean ± Standard deviation) of healthy volunteers

Temperament	Serum creatinine mg/dl	Serum Iron ng/ml	Serum Na+ Meq/lit	Serum K+ meq/lit	Serum T3 ng/dl	Serum T4 ug/dl	Insulin Units Uiu/ml
Damavi	1.001 ±0.04	128.43 ±29.02	126.42 ±18.98	3.78 ±0.73	0.84 ±0.24	8.62 ±1.34	62.71 ±10.28
Balghami	0.99 ±0.05	120 ±25.19	128.84 ±14.51	3.69 ±0.74	0.88 ±0.62	8.45 ±1.48	61.04 ±12.78
Safravi	0.94 ±0.029	125.21 ±10.01	126.27 ±19.79	3.80 ±0.69	0.97 ±0.19	9.41 ±2.85	61.98 ±10.60
Saudavi	0.74 ±0.05	142.03 ±40.89	124.53 ±16.48	3.88 ±0.74	1.33 ±0.18	7.97 ±1.35	65.49 ±18.44

Table 6: Physiological investigations (Mean ± Standard deviation) of healthy volunteers

Temperament	Hb%	R.B.C Cu.mm	W.B.C cu.mm	Neutro-Phils%	Lympho-Cytes%	Eosino-Phils%	Mono-Cytes%	Baso-Phils%	E.S.R. (I hour)mm	E.S.R. (II hour)mm
Damavi	13.99 ±1.46	5.26 ±0.61	7650.33 ±1249.48	52.74 ±10.41	40.48 ±10.65	4.5 ±2.02	2.10 ±0.17	0.05 ±0.03	12.17 ± 6.61	25.10 ±10.57
Balghami	13.19 ±1.36	4.89 ±0.62	7678.57 ±1041.04	54.99 ±10.92	39.68 ±10.30	3.75 ±1.97	2.11 ± 0.16	--	17.71 ±7.16	34.82 ±12.33

Safravi	14.0 ±1.51	5.26 ±0.60	7588.88 ±1262.03	55.29 ±9.69	37.45 ±8.98	4.15 ±2.43	2.0 ±0.19	--	11.44 ±5.21	24.12 ±9.49
Saudavi	13.7 ±1.89	5.20 ±0.74	6795.55 ±1383.93	54.75 ±9.42	39.08 ±9.42	4.5 ±2.59	2.15 ±0.29	--	13.68 ±6.65	29.79 ±10.34s

Table 7: Physiological investigations (Mean ± Standard deviation) of healthy volunteers

Temperament	Bicycle Ergography		Pulse		Hand Grip		PH	
	Rotation	Time consumed Min	Before Exercise	After Exercise	Left Kg.	Right Kg.	Sweat	Saliva
Damavi	560.46 ±93.81	7.3 ± 2.2	79.79 ±11.51	107.96 ±12.2	32.67 ±15.92	35.81 ±17.02	6.5 ±0.48	6.68 ±1.22
Balghami	367.58 ±78.24	3.7 ± 2.3	79.27 ±10.3	99.08 ±10.35	22.11 ±15.63	24.94 ±16.75	6.53 ±0.37	6.64 ±0.24
Safravi	528.87 ±60.14	4.6 ±3.4	78.83 ±11.51	105.78 ±19.9	32.45 ±15.55	35.68 ±16.76	6.54 ±0.40	6.66 ±0.20
Saudavi	717.27 ±172.18	5.46 ±2.8	81.26 ±15.39	111.3 ±12.29	30.18 ±18.24	31.34 ±20.61	6.48 ±0.40	6.59 ±0.33

Table 8: Physiological investigations (Mean ± Standard deviation) of healthy volunteers

Temperament	Tidal volume ml	Minute volume ml	Vital capacity ml	Timed vital capacity Ml	Expiratory capacity ml	Inspiratory capacity ml	Expiratory reserve volume ml	Inspiratory reserve volume ml
Damavi	698.67 ±175.28	15025 ±2263.05	1709 ±526.70	2849.60 ±1334.61	986.47 ±415.86	1758.22 ±740.48	426.08 ±141.28	991.8 ±260.74
Balghami	599.32 ±130.84	11363.62 ±1212.12	1455.38 ±450.76	1210.95 ±651.28	865.53 ±465.98	1420.67 ±580.64	344.07 ±137.22	827.57 ±233.46
Safravi	640.93 ±103.2683	13810.84 ±3558.08	1626.18 ±663.93	1581.95 ±719.93	1012.93 ±557.69	1581.81 ±615.66	377.04 ±126.56	881.76 ±231.34
Saudavi	610.22 ±255.01	12795.94 ±2536	1633.99 ±846.37	1465.49 ±841.92	1296.62 ±490.08	1568.29 ±605.72	445.45 ±135.14	824.71 ±243.86

Table 9: Physiological investigations (Mean ± Standard deviation) of healthy volunteers

Temperament	Basal Metabolic rate		PEFR (Peak Expiratory Flow Rate) lit/min
	+	-	
Damavi	16.31 ± 8.24	19.73 ± 10.32	430 ± 162.35
Balghami	21.46 ± 11.23	16.26 ± 8.26	255 ± 119.29
Safravi	16.15 ± 9.36	19.81 ± 6.25	560 ± 157.35
Saudavi	17.35 ± 7.7	15.54 ± 7.95	230 ± 126.62

Results and Discussion

Healthy Volunteers

Out of the 452 healthy volunteers studied, 150 cases were Damavis, 154 Balghamis 102 Safravis, and 46 Saudavis. They also revealed their binary qualities which is evident from the tables. The temperaments were assessed as per the scoring system (Table 1, 3). Age and sexwise distribution of cases have been presented in (Table 2).In these 452 subjects no Motadil subjects were obtained.

A. Correlation of biochemical parameters with various Temperaments

(1) *Damavi (Sanguine)*

Regarding blood viscosity it has been found to be moderate but there were no significant alterations of blood viscosity in relation to other temperaments. According to Nafisi blood is moderately viscous neither too thin nor too thick in Damavis subjects. Our results are in line with that of the unani concept.

Blood glucose is indicative of energy utilization by the body and proper homeostasis of the body. As, Damavis are supposed to be the most active of all the four humors, hence it may be also supposed that glucose plays an effective role in the metabolism processes in them and hence they should present a physiologically lower profile of blood glucose – which is very well evident from our laboratory investigations.

The Damavi (Sanguine) subjects should possess a physiologically normal profile of cholesterol. As per our investigations the levels of cholesterol in Damavis do not corroborate with that of Unani concept but as the level of cholesterol is influenced by many factors hence it is difficult to reach any conjecture.

Rotubat-e-Fazlia is those which are produced during the normal course of metabolism but are not useful to the body. As per Unani concept they are the products of Ihtiraq (Burning part of which can be considered as oxidation). The body has its unique mechanism of maintaining its own balance. Burning, part of

which can be considered as the body expels away the urea/ the major pathway of nitrogen excretion in human is urea through the Krebs-Henselect cycle and it also helps to maintain the acid base balance of the body. As, the Damavis are presupposed to have a healthy constitution hence the level of urea should be present in a physiologically moderate level. Our findings are in accordance with the above mentioned concept.

As far as the serum protein, albumin and globulin levels are concerned, there were no significant correlations with the four temperaments. Cells utilize energy to overcome the general tendency towards disorder. Proteins mediate and react and form structure that generates order in the body. Serum protein, albumin and globulin function in the maintenance of colloidal osmotic pressure, pH and electrolyte balance transport of metal ions, fatty acids steroids, hormones, drug etc are related to homeostasis. Plasma proteins function as a labile protein storage medium and represent a rapidly available source of amino acid. Albumin acts as carrier molecule of fatty acid, bilirubin, and trace elements many drugs and prevents intravascular thrombosis. Therefore, albumin can be considered as correlated with Khilt-e-Dam, but the dominance of albumin is not evident from our study. Globulin is responsible for natural and acquired immunity. So, naturally it would not dominate in case of Damavis. Due to the anabolic and catabolic processes the blood level of proteins is maintained more or less at a constant level and probably there should be no significant quantitative differences between the four temperament groups.

The liver function test results are in line with that of the Unani concept. The Damavis should show normal physiological values, which is seen in this case. The Alanine Amino Transferase, Serum (AST / SGPT) is one of the markers of liver efficiency, whose normal levels in Damavi persons is in accordance with the Unani claim that Damavi persons possess a good metabolic capacity apart from its other temperament.

The Creatinine level is physiologically normal in Damavi subject, which is also in concordance with the Unani concept. Creatinine diffuses from muscle into the blood and is excreted in the urine as waste product. It is proportional to muscle mass. Hence creatinine should play a dominant role in Damavis, as Damavis are supposed to be muscular in nature as well as active in comparison to the other temperaments.

The serum iron should also be present in a significantly higher proportion in the Damavis but actually the iron compound of serum along with other constituents is the khilt-e-Sauda. The profile of serum iron in Damavis is well in line with the unani concept.

The serum electrolytes (Na+ & K+) help in many physiological functions e.g. acid-base balance, transmission of nerve impulses etc. The normal level seen in Damavis in the course of the study is in concordance with the Unani concept.

The hormones T3 and T4 were studied and the data generated during the studies are not in concordance with the Unani concept. These hormones play an important role in the efficient management of the metabolic processes and hence they should be present with a physiologically higher profile in Damavis as well as Safravis. But, the data generated during the process of our study is not in accordance with this expectation.

Regarding insulin, which as per Unani concept should be moderate in Damavis than its other counterparts, but the reported results were not in accordance with this hypothesis.

(2) *Balghami (Phlegmatic) (Tables 4, 5, 6)*

The Balghamis should elicit a higher blood viscosity because as per Abu Sohel Maseelu khilt-e-Balgham mixed with blood lubricates it by increasing its quiwam. During the course of our investigations we have found that the values are physiologically towards the higher level which is in concordance with the Unani concept.

As blood glucose is indicative of energy utilization of the body, metabolism etc. hence as the energy utilization by Balghamis is less, their metabolism slack hence they should be presented with a physiologically higher profile but the results obtained does not corroborate with it.

The higher level of cholesterol in Balghamis is in conformity with that of observations by unani physicians. Fat and other lipid product are distinguished as Akhlath-e-Balghamia as per Unani concept.

As urea is the end product of metabolism which is attributed to Safravi, hence Balghamis should be presented with a physiologically lower profile of blood urea as Balghamis also do posses poor metabolic efficiency. Of the serum proteins, albumins and globulins, the globulins are attributed to Balghami and hence in case of Balghami's globulin should dominate the scenario, though the globulin content is physiologically on the higher side on observation but if compared with other temperaments the differences are insignificant.

Regarding liver function tests due to its lesser efficiency it should elicit a physiologically lower profile of bilirubin as well as SGPT. But interestingly enough, we get a very different picture from our studies. Still, as the results are discordant more deep seated studies are required to justify the matter. There are also many other factors which needs to be addressed.

As creatinine levels are directly proportional to the muscle mass hence they should be of lower profile in Balghamis. The results depicted here are not in concordance with the Unani concept.

The serum iron content is significantly lower in Balghamis that that of Damavi's and Saudavi's which is in concordance with the unani concept.

The moderate level of Na+ and K+ ions are not in concordance with the Unani concept as Na+ and K+ have functions which can mostly be attributed to Damavi's and Safravi's.

As per the functions of T3 and T4 are concerned and an analysis of Balghamis classification by unani physicians reveals the fact that the above hormones should be presented at a physiologically lower level and the results elicit the fact.

The insulin concentration should have been physiologically lower in Balghamis as per their characteristics are concerned but the findings do not corroborate with the age-old concept.

(3) *Safravi (Bilious)*

According to Nafisi the yellow colour of blood plasma in the blood is khilt-e-safra which attenuates (Tarqiq) the blood and causes it to diffuse through narrow passages i.e. safra decreases the viscosity and causes it to lower through narrow passages. The data generated during our studies reveals lower (physiologically) blood viscosity than other temperaments which adds further increment to the Unani concept.

Sugar is the most important constituent of carbohydrate metabolism and the level of blood sugar is definitely a marker of carbohydrate metabolism in the body. The safravi temperaments are endowed with a powerful digestive system as well as a hyperactive (physiologically) nervous system. As physiology is concerned, carbohydrates play a very dominant role in both the above systems hence in safravi cases the blood glucose should be present at a lower profile. As regards safravi cases are concerned the blood glucose level is physiologically lower and therefore in concordance with the unani concept.

According to Unani classics khilt-e-safra digest food, emulsify fat and dissolve it. It acts as a stimulant and helps in the excretion, therefore safravi temperaments should reveal physiologically lower physiological level of cholesterol which is very well evident from our investigations where the cholesterol is significantly lower ($P<0.001$) than the other temperaments. Urea is the end product of metabolism and in accordance to Unani theory they are the products of Ihtiraq (oxidation). Though, they are produced during the normal course of Istehala (metabolism) but they are not useful to the body. As khilt-e-safra is a complex fluid consisting

of a number of compounds which are excretory and secretory in nature, so urea levels will play a dominant role i.e. it is presumed to present a physiological higher profile, but, the results of our investigation do not support the concept.

Plasma proteins like safra (albumin & globulin) are synthesized in the liver. Safra is a complex fluid consisting of a number of compounds produced as part of metabolism which has definite functions in the homeostatic processes in the body. Safra is a secretory product, it acts as a stimulant, it activates enzymes (khamuirat) and is responsible to control and mediate, react and generate order in the body like proteins though, proteins alongwith albumin and globulin may be designated as safra but the anabolic and catabolic processes taking place in the bodily systems does not allow any room for quantitative difference in between four temperaments. Hence, the values in all the four khilts are more or less same.

Bilirubin content is attributed to safra and hence it should be at an elevated level in Safravi subjects but our studies do not confirm the fact. Regarding Alanine Amino Transferase, Serum (ALT/SGPT), which is an active marker of liver efficiency, the Alanine Amino Transferase, Serum (ALT/SGPT) levels should be lower in Safravis and the results are in line with that of our presumption.

As serum creatinine concentration is related to muscle mass hence it is natural that it will be dominant in Damavis followed by Safravis, the Creatinine levels are justified in the tables.

As serum iron is mostly attributed to sauda hence it should be of average levels in case of Safravi which is in line with that of the data generated during our studies.

Safra includes in its composition as well as functionality electrolytes and other metal ions, fatty acids, hormones etc, hence the electrolyte levels may be presupposed to be physiologically higher in Safravi but the data generated during our studies do not reflect the above phenomenon.

T_3 and T_4 are associated with increase in BMR, good metabolism, lowering of cholesterol, and it has profound effect on metabolism and O_2 consumption therefore T_3 and T_4 should elicit an elevated level in Safravis of healthy volunteers, hence the physiologically elevated profile requires no further justification.

(4) *Saudavi (Melancholic)*

Haley Abbas maintained that the temperament of sauda is cold and dry which adds thick consistency to the blood. Therefore the viscosity should be maximum in Saudavi Mizaj person and in the data generated from our studies Saudavi subjects have been presented physiologically the highest physiologically normal value in between four temperaments.

Saudavi (cold and dry) Mizaj subjects are lean in physique, false appetite, eccentric in nature hence they should have physiologically higher level of blood glucose but which is not confirmed from our studies. As per Unani classics Khilt-e-Sauda makes the blood viscid. Sauda increases with age and may result in the development of atherosclerotic plaques. Hence, the higher profile of cholesterol in Saudavis is well justified.

Serum bilirubin being chiefly a safra constituent is presumed to maintain a moderate normal physiological profile which is very much evident from the studies. As Saudavis subjects are subjected to less metabolic efficiency hence the SGPT levels should be physiologically higher in Saudavis subjects but it is not reflected in the results. The proteins being Safravi in nature, hence they do not reflect any alterations in the Saudavis. However as the immunological system of the Saudavi is not very active hence there might be some relation between globulin and sauda. But, as previously said that the anabolic and catabolic processes go on simultaneously to maintain the bodily homeostasis and so it is difficult to make any very minute quantitative difference between any four temperaments – it should always be dealt on a broader perspective.

As urea represents the products of end product metabolism hence it is sauda in nature and therefore the urea level in Saudavis subjects is presumed to be physiologically higher. The physiologically higher normal value of urea in Saudavis is in concordance with the Unani concept. As serum Creatinine is related to muscle mass hence their lower levels in Saudavis can be presumed but the data generated during our studies requires further introspection.

The iron compounds of serum along with other constituents are the Khilt-e-Sauda of the blood admixture. According to Unani concept the color of sauda is jet black, dark ashy and violet. It renders thick consistency and increases the viscosity of blood and renders nutrition to bones according to Haley Abbas. The data generated during our studies is in concordance with that of Unani concept.

The serum electrolytes does not represent sauda and hence as per Unani concept they should be physiologically at a low level, but as per our studies no such differences are elicited between four temperaments – nor it is physiologically lower in sauda.

As Saudavis does not contribute towards an efficient metabolism hence their T_3 and T_4 profiles should be physiology lower but whereas T_4 elicited a lower level T_3 elicited a higher level.

Insulin is supposed to be lower in Saudavis but it is found physiologically higher in Saudavis which cannot be justified in the context of scientific relevance.

B. Correlation of Physiological and Haematological Parameters with Temperaments

(1) *Damavi (Sanguine)*

As per the Unani philosophy the Damavis are presumed to possess a better R.B.C. count and a higher percentage of Haemoglobin. The results obtained during the process of investigations reflect a positive profile of the above mentioned parameters. Regarding the WBC count as the Damavis are less prone to infections so it is natural that the WBC counts should be lower than others especially Balghamis. The physiologically normal levels elicited by the Damavis when considered singularly are in concordance with that of the unani concept. Though as per the age old concept WBC (neutrophils) included are regarded as khilt-e-balgham, but a deep study into their functional aspect reveals that it may be also attributed to khilt-e-sauda. The eosinophil levels are within the normal range as well as the basophils. Hence, they are in line with that of unani concept in Damavis.

In short, the lymphocytes are responsible for the phenomenon called immunity and as per unani concept the body has its own defence mechanism. As per the immunological reactions are concerned any foreign substance in the body leads to production of a clone of lymphocytes. Hence, as per rationality it should be higher in Balghamis and Saudavis who as per unani concept are held responsible for being more prone to disease infections. But, as far our studies are concerned, though the level of lymphocytes in Damavis are rational the others remain unexplained, monocytes play also a role in immunity so, they should be present in normal levels in case of damavis subjects and our studies confirm it.

Erythrocyte Sedimentation Rate (E.S.R): increases in all chronic and acute infections. It's accelerated rate suggests organic disease rather than functional disorder. Most infections, inflammation and destructive diseases e.g. rheumatoid arthritis, tuberculosis, cancer etc. as per unani classics these should be included in khilt-e-sauda or Balghamis. Hence, Damavis and Safravis in healthy volunteers should possess a lower ESR value than its two other counterparts. The ESR value presented in the table further adds increment to the Unani concept.

Basal Metabolic rate (BMR): Energy released from breakdown of carbohydrates, fats and proteins appears as heat and Adenosine Triphosphate (ATP) is generated during the metabolism of the products through the Tricarboxylic acid cycle (TCA cycle), electron-transport chain and oxidative phosphorylation. This energy is used by our body for maintaining the normal homeostasis of our body.

Basal Metabolic Rate means the rate of energy utilization of the body under standard resting conditions – and is an excellent tool to study the overall metabolism of the body. In the unani concept metabolism plays a very significant

role for maintenance of homeostasis of the body. As the Damavi temperament person is ascertained the status hot and wet so they should also have a higher rate of BMR which also relates to heat production in the body. Damavis are also associated with an effective metabolism, but the results obtained during the course of our investigations is not at par with that of unani concept – may be other factors such as age, sex etc. should also be given due consideration.

The lung function tests are the lung volumes and capacities under different conditions of breathing. As per unani concept Balghamis and Saudavis are presented with a lower respiratory efficiency than Damavis and Safravis. Higher levels of volumes in Damavis have been obtained.

Hand - grip: is a simple test for assessment of sympathetic function activity. The hand grip was significantly ($P<0.001$) higher in Damavis than its counterparts. Damavis as per Unani concept are supposed to possess a well built body i.e. musculoskeletal system along with a well developed Central Nervous System (CNS) and Autonomic Nervous System (ANS) hence a higher value in this temperament is well justified.

The assessment of cardiovascular status as well as physical fitness of an individual was done through Bicycle ergography and Electrocardiography. In ergometry various physiological changes from a resting level to a working level were noted. It is possible to determine in what degree the working level differs from the resting level by ergometer. In ergometry mechanical work is imposed on the body, but even after stoppage of mechanical work physiological work continues in the body till rest. A complete work cycle indicates the physiological cost of work and physiological cost of recovery. During exercise coordinated efforts of all the systems e.g. cardiovascular system, respiratory system, nervous system and muscles are required for accomplishment of any physical work. As the damavis as per unani concept are endowed with a well developed cardiovascular, respiratory and nervous system and hence they have greater physical efficiency.

As per our observations the results reflects that in damavis all the system work in harmonized matter to produce greater physical efficiency resulting in higher Physical Fitness Index (PFI) of an individual.

Pulse: The tracings of pulses were monitored by the Vaslab IV vascular recorder and it was correlated with that of the unani physician's clinical examination.

In damavis the unani physicians attribute them to a large, strong, quick, rapid, soft and hot in character.In many of the cases, as is evident, the pulse can be interpreted as quickly (as its time between two tracings are very well maintained), large (which is evident from calculation of the height), rapid. The graph also indicates a shorter diastolic period. However, the pulse tracings more or less are in concordance with the pulse of damavis as clinically observed by physician.

(2) *Balghami (Phlegmatic)*

As far as the function of hemoglobin and R.B.C. are concerned and their interpretations by unani physicians, it becomes clear that Hemoglobin and RBC should be presented in a physiologically lower profile than other. The Balghamis have presented a lower profile than its other temperaments and thus the findings corroborates with the Unani concept.

As far as the WBC as well as their differential count are concerned as the Balghamis are constitutionally weak and are very often subjected to infections hence all the above parameters should be presented in a higher physiological profile in Balghamis.

As far as ESR are concerned and as its pathological values are suggestive of chronic and acute infections and as Balghamis are also very quickly prone to infections therefore, it may be presumed that Balghamis along with Saudavis should reveal a physiologically higher profile of ESR in healthy volunteers. The ESR values are significantly ($P<0.001$) higher in Balghamis than others and thus fully corroborates with the unani concept.

The basal metabolic rate plays a very important role in the maintenance of homeostasis. As the body's metabolism plays a key role in the determination of BMR hence those khilts e.g. khilt-e-Balgham and khilt-e-sauda which are associated with lower metabolic rate will also reveal a lower profile of BMR – and as also Balghamis are associated with a cold and wet temperament. But, as per our investigations it presented a different picture. This deviation may be due to a number of factors as BMR is controlled by many factors – in depth studies are required for such concluding observations.

As per unani concept the Balghamis are associated with also a reduced respiratory efficiency along with the controlling system of all is the nervous system which is presumed to be hypoactive in case of Balghamis. Though the Balghamis in the datas generated a low profile than other temperaments the observations to some extent corroborates with that of unani concept. The value of Timed Vital Capacity (TVC) is particularly interesting it is significantly ($P<0.001$) lower than other temperaments.

The cardiovascular status along with the Physical Fitness Index (PFI) of an individual is determined by Bicycle ergometry, where physical work is imposed on the subject to find out the physiological efficiency of the individual. All the bodily systems here work in a coherent manner to exercise efficiency. As Balghamis as per unani concept possesses an weaker cardiovascular system, respiratory system, muscular system and overall less active Central Nervous System (CNS) as well as Autonomic Nervous System (ANS) so it is usual that they will keep up a low profile of work output which is reflected in the results.

Hand-grip is significantly (P<0.001) lower in Balghamis which corroborates with the unani concept which also reflects that Balghamis are in possession of a less developed ANS along with a lower isometric tension.

Pulse: As per unani concept the Balghami pulse is said to be deep slow, late, soft, cold. Taking into consideration the above mentioned factors, the pulse tracings were taken and the amplitude, height, rate etc. of the wave-form was taken into account and it was seen that most of them corroborated with the unani concept.

(3) Safravi (Bilious)

As per the Unani concept the R.B.C.'s and Hemoglobin% should be physiologically moderate, which is also evident from the results?

The WBC alongwith differential count is presumed to present a moderate profile because after Khilt-e-Dam, Khilt-e-Safra is known for all its systems working in a harmonized manner which is reflected also in the data generated during our studies.

As Safravis are less prone to chronic and acute infections and possess a well developed immune system hence the significantly lower profile of Erythrocyte Sedimentation Rate (ESR*)* is also well justified.

As per Unani concept metabolism plays an important role in maintenance of homeostasis. During studies on basal metabolic rate the profile revealed was lower but according to unani classics the Safravi subjects should be presented with a better profile of Basal Metabolic Rate (BMR) as safra is associated with active metabolism – excessive energy output etc. The result obtained therefore is not concordant with the Unani classics and therefore requires further insight into the area.

As the lung functions are concerned the respiratory efficiency is better in Safravis than Saudavis and Balghamis. Our results corroborate with that of the Unani concept.

The physical fitness of the Safravi individuals are at the highest level, because the controlling faculty of all the systems the nervous system is at its highest potential at this temperament which is also reflected in the data generated.

The hand-grip tests a marker of Autonomic Nervous System (ANS) as well as isometric contraction, reveals a higher level in comparison to balghamis which is in concordance with the Unani concept.

Pulse: of Safravi individuals are narrow, rapid, quick. They are faster than that of damavis but they aren't that strong enough like Damvis as per Unani concept. The graphical representation denotes a fast, narrow pulse but the height should be less than that of Damavis.

(4) *Saudavis (Melancholic)*

As per the unani concept the Saudavis mizaj should provide with a physiologically level of RBC and Hemoglobin% which is reflected in the results.

The WBC along with their differential count should be physiologically higher in Saudavis as sauda is related to diseases and as Saudavis possess a weak constitution but it is not evident from the results.

The ESR should also be higher in Saudavis as per Unani concept as they are prone to infections but the data reveals only normal moderate values which does not help us to reach any conjecture.

Cold and dry Saudavis Mizaj is presumed to present a low BMR as they produce physiologically lower level of ATP thereby less heat. The Saudavis subjects have presented low BMR values which are in concordance with Unani concept.

The respiratory system is not that much efficient in Saudavis, which results in a reduced respiratory efficiency but as per the results of the respiratory efficiencies it revealed a physiologically higher profile. It might be due to the fact that due to the eccentric nature of Saudavis which may have resulted in hyperirritability – thereby leading to hyperactivity of the nervous system and there might have been some alterations in the respiratory centers which have led to production of these types of data.

The same applies to bicycle ergography the khilt –e-sauda makes the constitution eccentric which have resulted in higher profiles.The hand grip test also revealed higher values which further confirmed their eccentric nature.

As per Unani concept the pulse of Saudavis are deep, slow, late, hard, the slow and late features are much slower than that of Balghamis.

The graphical representation of the Saudavis pulse also elicits the same, slow, late. The dicrotic notches are present and do not reveal the loss of elasticity. But, as all the pulse tracings concerned, the least efficient are being the Saudavis, than that of Balghamis, Damavis and Safravis. In, one word it possess a less efficient cardio-vascular as well as nervous system because both of them have to work in a coherent harmonious manner for better efficiency – better management of the controlling centers will no doubt lead to a perfect homeostasis – leading to a healthy individual (physiologically, mentally and socially as per WHO nomenclature).

Studies on the Theory of Akhlath at CRIUM, Hyderabad under the Fundamental Research programme of CCRUM, New Delhi armed with quality research, research methodology and qualified research personnel, have developed preliminary support for the validation of the humoral theory and are also definitely

poised to establish evidence based scientific support for the fundamentals of Unani System of Medicine in the years to come.

Every system of Indian thought (i.e. the philosophy of humours in Unani Tibb and its scientific relevance) is not merely a philosophy to be intellectually appreciated, not merely a science for explaining but it is also a religion to be lived and not merely believed. In order to move ahead in this technology oriented century we need to further strengthen our philosophies by deep-seated and meaningful scientific research and validations through different projects in fundamental research programme so that the positive factors can finally help us to reach a conjecture where hypothesis will turn into a solution.

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Microscopic Profile of Selected Powdered Herbal Material of Commercial Significance

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Abstract

Microscopy permits the identification of the herbs and the detection of individual components of the mixture by examining their unique features like histological structures, cells and cell contents. It is of great value in case of comparative analysis of broken and powdered products because in such cases most of the morphological diagnostic features are lost. Present study emphasizes microscopic profile of some selected powdered herbal materials of commercial significance, namely, *Glycyrrhiza glabra* L. (root), *Nardostachys jatamansi* DC (rhizome), *Curculigo orchioides Gaertn*. (rhizome), *Terminalia chebula* Retz. (pericarp), *Syzygium aromaticum* Merr & L.M. Perry (Floral bud), *Cassia angustifolia* Vahl (leaf), *Santalum album* L. (heart wood), *Rhus coriaria* L. (fruit), *Apium graveolens* L. (seed) and *Carum carvi* L. (fruit), taking into account the corresponding plant part used, namely, bark, root and rhizome, leaf, flower, fruit and seed. These studies will provide referential information for correct identification of drugs studied and help in checking adulteration in market samples of herbal medicines used in the preparation of various compound formulations.

Keywords : Microscopic profile, Herbal material, Histological structure.

Introduction

Today, with the surge of interest in phytotherapeutics, the availability of genuine plant drug material is becoming scare, partly due to indiscriminate exploitation of medicinal plant wealth and depletion of forest and other resources out of greed to obtain the maximum drug yield. This has led to the use of substituted and adulterated drugs to meet the demand of authentic ones. In such cases, accurate identification becomes a difficult task, especially when the supplied drug material is dried and made into powder form because then it loses its morphological identity and easily prone to adulteration.

Now a days sophisticated modern research tools for evaluation of plant drugs are available but microscopic studies are still one of the simplest and cheapest method to establish the correct identity of the source material. Microscopy permits the identification of the herbs and the detection of individual components of the mixture by examining their unique features like histological structures, cells and cell contents. In this direction in recent years, a number of studies have been conducted on micro-morphology of powdered drugs (Rai *et al*., 2011, 2012a,b,c,d, 2013, 2014, 2015, 2016a,b; Yadav *et al*., 2012) and others. Under this scenario, present study on 10 important widely used herbal drugs provides their microscopic profile taking into account the corresponding plant part used, namely, bark, root and rhizome, leaf, flower, fruit and seed (Anonymous 2001; 2004; 2006; 2007;

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2009). Botanical name; family name, description of the powdered drug along with its action and therapeutic uses in Unani system of medicine have been given (Anonymous, 2006; Chopra & Chopra 1969; Kirtikar & Basu, 1993; Nadkarni, 1976). These studies on powdered herbal material of various plant parts will provide ready referential information for correct identification and help in checking adulteration in market samples of herbal medicines used in the preparation of various Unani compound formulations (Anonymous, 2001; 2006; 2008; 2011). However, there is still a need to support these data with corresponding physico-chemical studies.

Methodology

Authentic crude drug samples procured from the market; powdered and sieved through 60 mesh. The powdered drug first cleared in the solution of chloral hydrate and then mounted in solution of chloral hydrate and glycerol to prevent the formation of chloral hydrate crystals during the examination of the slide. Lignification was established by the reaction with solution of phloroglucinol and hydrochloric acid. Several preparations with different mountants like iodine water, sudan III, ruthenium red, ferric chloride etc. were also made to emphasise the presence of particularly important cells or cell contents. Care has been taken to avoid the presence of any air bubble. Most diagnostic features and the dimensions of the cells and other particles were recorded following (Jackson & Snowdon, 1968; Johansan, 1940; Iyengar, 1997; Wallis, 1969). The respective photographs were taken from the digital microscope with computer attachment.

Observations

1. Asl-us Soos

Botanical name	:	*Glycyrrhiza glabra* Linn.
Family	:	Papilionaceae; Fabaceae
Part used	:	Root
Action	:	Coctive, concoctive, antiinflammatory, expectorant, carminative, diuretic, emmenagogue.
Therapeutic uses	:	Cough, sore throat, acutehoarsenes, asthma, burning micturition.
Improtant formulations	:	Dayaqooza; Habb-e-Ghariqoon;Habb-e-Surfa; Habb-e-SurfaQawi; Lauq-e-Hulba; Lauq-e-KhiyarShambar; Lauq-e-Nazli; Lauq-e-Sapistan;Lauq-e-Shamooms; Lauq-e-ZeequnNafas; Majoon-e-Mundi.
Powder study	:	Colour : Yellowish brown Odour: Faint, characteristic Taste : Sweet

Identifying features : (Fig. 1 – 4)

- Abundant starch grains which are simple, spherical to oval, 2μ-20μ in diameter.
- Pieces of lignified vessels with bordered pits having width 80μ-200μ.
- Pieces of thick walled lignified fibres.
- Abundant fibres present in groups surrounded by a calcium oxalate prism sheath.
- Abundant prism shaped crystals of calcium oxalate; 10μ-35μ in size. Majority of crystals forms the crystal sheath surrounding the fibers.

2. Balchar

Botanical name : *Nardostachys jatamansi* DC

Family : Valerianaceae

Part used : Rhizome

Action : Carminative, laxative, stimulant, diuretic, stomachic, antispasmodic, emmenagogue, nerve sedative, tonic, deobstruent, promotes appetite and digestion.

Therapeutic uses : Jaundice, leprosy, skin diseases, throat troubles, ulcers, palpitation of heart, intestinal colic and flatulence, used in the treatment of snake bite or scorpion sting.

Important formulations : Habb-e-Mumsik Ambari; Jawarish Amla Sada; Khamira Abreshem Hakim Arshadwala; MajoonAzarazi; MajoonChobchini Ba nuskha Kalan; Majoon Dabi-ul-Ward; Majoon Khabsul Hadeed; Qalbeen; Maullaham Khaas; Sharbat-e-Faulad;

Powder study : Colour : Reddish brown
Odour :Strongly aromatic
Taste : Slightly bitters

Identifying features : *(*Fig. 5 – 8*)*

- Fragment of cork cells in surface view composed of thin walled, rectangular cells.
- Pieces of lignified vessels with reticulate thickening; present either single or in groups.

- Pieces of simple, lignified; moderately thick walled fibres.
- Parenchyma cells containing oil globules.

3. Musli Siyah

Botanical name	:	*Curculigo orchioides* Gaertn
Family	:	Amaryllidaceae
Part used	:	Rhizome
Action	:	Demulcent, diuretic, tonic, aphrodisiac.
Therapeutic uses	:	Asthma, piles, jaundice, diarrhea, colic, gonorrhea.
Important formulations	:	Habb-e-Asgand; MajoonBandkushad; Majoon Muqawwi Rahan; Majoon-e-Piyaz; Majoon-e-Regmahi.
Powder study	:	Colour :Greyish Odour : Aromatic Taste : Mucilagenous& slightly bitter
Identifying features	:	(Fig. 9 – 13)

- Abundant starch grains; either simple or compound upto 2-4 components; spherical to oval; measuring 4µ-21µ in diameter.
- Numerous acicular crystals of calcium oxalate present either single or in groups.
- Pieces of vessels with spiral and annular thickenings.
- Fragment of cork cell in surface view.
- Pieces of lignified thick walled fibres with narrow lumen present either single or in groups.

4. Post-e-HalelaKabli

Botanical name	:	*Terminalia chebula* Retz
Family	:	Combretaceae
Part used	:	Pericarp
Action	:	Laxative, stomachic, tonic, alterative, purgative, carminative, anthelmintic, antidysenteric.
Therapeutic uses	:	Asthma, ophthalmia, piles, diseases of spleen, strengthen brain, eyes, gums, used in paralysis.

Important formulations : Habb-e-KabidNaushadari; Habb-e-Muquil; Habb-e-Shabyar; Habb-e-DeedanQawi; Habb-e-Halela; Habb-e-Man-e-Hamal;Habb-e-MuqilQabiz; Habb-e-Nuzul-ul-Ma;Habb-e-Sakta; Habb-e-Sana; Habb-e-Asha; Habb-e-Jaiyed; Habb-e-Kaaboos; Itrifal-e-Sagheer; Itrifal-e-Shahtara; Itrifal-e-Ustukhuddus; ItrifalZamani; Itrifal-e-Aftimoon; Itrifal-e-Badiyan; Itrifal-e-Habb-ul- Qara; Itrifal-e-Khabs-ul-Hadeed; Itrifal-e-Muqil; Itrifal Mundi; Jawarish-e-Fanjnosh; Majoon-e-Muqil; MajoonMusaffi-e-Khoon; Majoon-e-Najah; Majoon-e-Seer AlviKhani; Majoon-e-Fanjnosh; Majoon-e-JograjGugal.

Powder study : Colour : Yellowish brown
Odour : Agreeable
Taste : Astringent

Identifying features : (Fig. 14 – 17)

- Fragments of epicarp in surface view appear as polygonal thick walled cells.
- Abundant fibres, occur mostly in groups; are thick walled, lignified, with or without simple pits; having width 9µ-18µ.
- Sclereids usually found in groups, various shaped *(*oval, rectangular, elongated*);* narrow lumen with pits and having dimensions 158µ- 180µ x 27µ- 32µ.
- Abundant starch grains which are simple, round- oval in shape; measuring 2.25µ-6.75µ in diameter.

5. Qaranful

Botanical name : *Syzygium aromaticum* Merr & L. M. Perry

Family : Myrtaceae

Part used : Floral bud

Action : Anti- inflammatory, antiseptic, exhilarant, analgesic, cardiac tonic, brain tonic, liver tonic, intestinal tonic, expectorant, anti convulsent, stomachic.

Therapeutic uses : Ozostomia,odontalgia (toothache), hepatosis, dyspepsia, flatulence.

Important formulations : Habb-e-Ambar; Habb-e-AmbarMomyaee; Habb-e-turshMushtahi; Habb-e-Hamal; Anoshdaru; Jawarish-e-Narmushk; Jawarish ZarooniSada; Jawarish-e-Bisbasa; Jawarish-e-Utraj; Jawarish-e-jalinoos; Jawarish-e-OodTursh; Khamira-e-AbreshamArshadwala; Majoon-e-Dabeedul Ward; Majoon-e-Fanjosh; Majoon-e-Suparipak; Majoon-e-Muluki; Majoon-e-Seer; Majoon-e-Khadar; Majoon-e-Arad Khurma; ItrifalGhudadi

Powder study : Colour : Dark brown
Odour : Strongly aromatic
Taste : Astringent

Identifying features : (Fig. 18 – 21)

- Abundant pollen grains which are small, biconvex with a rounded; triangular outline and smooth exine measuring 15µ-20µ in diameter.
- Abundant rosette crystals of calcium oxalate measuring 10µ- 15µ in diameter.
- Fragment of hypanthium consisting of oil glands embedded in parenchyma cells.
- Pieces of lignified fibres with bluntly pointed ends and thick walls.

6. Sana leaf

Botanical name : *Cassia angustifolia* Vahl

Family : Caesalpiniaceae

Part used : Leaf

Action : Blood purifier, anti emetic, deobstruent, detergent, drug clearing bad humour from brain.

Therapeutic uses : Arthralgia, lumbago, hip pain, sciatica, gout, asthma, scabies, acne, pimples.

Important formulations :

Powder study : Colour :Greyish green
Odour :Faint; characteristic
Taste :Mucilagenous; slightly bitter

Identifying features : (Fig. 22 – 26)

- Fragment of epidermis in surface view showing paracytic stomata.
- Fragment of epidermis in surface view showing unicellular, non glandulartrichomes.

- Groups of palisade cells.
- Prismatic crystals of calcium oxalate present in the cells of the parenchymatous sheath surrounding the groups of fibres.
- Lignified thick walled fibres surrounded by calcium oxalate prism sheath.
- Pieces of vessels with pitted walls.

7. Sandal Safaid

Botanical name	:	*Santalum album* Linn.
Family	:	Santalaceae
Part used	:	Heart wood
Action	:	Exhilarant, sedative, antiseptic, expectorant.
Therapeutic uses	:	Palpitation, burning micturition, gonorrhea, cough.
Important formulations	:	Habb-e-Musaffi-e-Khoon; Habb-e-Yaqoot; Habb-e-Kafoor; Habb-e-Humma-e-Murakkaba; Habb-e-Kaffor Marwaridi; Habb-e-Qula; Habb-e-Sandal Mutalla; Habb-e-Bawaseer Badi; Habb-e-Lulvi; Itrifal Zamani; Jawarish-e-Aamla Sada; Jawarish-e-Tamar Hindi; Jawarish-e-Zarishk; Jawarish-e-Tabasheer; Jawarish-e-Aamla Luluvi; Jawarish-e-Aamla Ambari; Khamira-e-Marwareed; Khamira-e-Gaozaban Ambari Jawahirwala; Khamira-e-Gaozaban Sada; Khamira-e-Abresham Sada; Khamira Sandal Sada; Khamira Abresham Sheer Unnab Wala; Khamira Nazli Jawahir Wala; Majoon-e-Lana; Majoon-e-Masik-ul-Baul; Majoon-e-Sohag Sonth; Majoon-e-Ushba; Majoon Azraqi; Majoon Suhag Sonth; Majoon Zanjabeel; Qurs-e-Zarishk; Qurs-e-Ziabetussada; Qurs-e-Atash; Qurs-e-Kafoor Mumsik; Qurs-e-Rewand; Qurs-e-Shifa Hindi; Qurs-e-Tabasheer Sartani; Sufoof-e-Qaranful; Sufoof-e-Ziabetus Sada; Sufoof Tabasheer Murakkab.
Powder study	:	Colour :Light brown Odour :Aromatic Taste :Slightly bitter

Identifying features : (Fig. 27 – 29)

- Pieces of simple, lignified fibres present either single or in groups.
- Pieces of pitted vessels.
- Groups of parenchyma cells filled with oil globules.

8. Sumaq

Botanical name : *Rhus coriaria* Linn.

Family : Anacardiaceae

Part used : Fruit

Action : Sedative, constipative.

Therapeutic uses : Bilious diarrhea, dysentery, nausea, vomiting.

Important formulations : Habb-e-Sumaq; Khamira Marwareed Banuskha-e-Kalan; Mufarreh Azam; Mufarreh Yaqooti Motadil; Safoof-e-Sumaq; Safoof-ul-Inab; Safoof-e-Kharnob; Sunoon Muqawwi Dandan; Dawa-ul-Misk Motadil Jawahar Wali.

Powder study : Colour : Dark brown
Odour : Aromatic
Taste : Bitter

Identifying features : (Fig. 30 – 32)

- Abundant characteristic horn shaped, multicellular trichomes, present either scattered or attached to the fragment of epidermis.
- Fragment of epidermal fruit wall in surface view showing moderately thick walled, polygonal epidermal cells radiating around small, circular cicatrices.
- Fragment of moderately thick walled palisade cells of the testa,
- Fragment of moderately thick walled parenchyma cells of the endosperm filled with oil globules.

9. Tukhm-e-Karafs

Botanical name : *Apium graveolens* Linn.

Family : Apiaceae

Part used : Seed

Action : Deobstruent, stimulant, appetizer, carminative, lithotriptic, emmenagogue.

Therapeutic uses : Sciatica, gout, dropsy, anuria (retention of urine), flatulence in stomach, renal calculus.

Important formulations : Banadiq-Buzoor; Habb-e-Khabs-ul-Hadeed; Habb-e-Mujarrab; Habb-e-Kabar; Habb-e-Mazaryun; JawarishZarooniSada;Jawarish-e-Falafili; Majoon-e-Kaknaj; Majoon-e-Fotnaji; Majoon-e-Aswad; Majoon-e-Dabeed-ul-Ward; Majoon-e-Hajr-ul-Yahood; Qurs-e-Anisoo0n; Qurs-e-Luk; Qurs-e-Istisqa; Qurs-e-Luboob; Safoof-e-Mohazzil; Safoof-e-Moya.

Powder study : Colour : Light brown
Odour : Aromatic
Taste : Aromatic

Identifying features : (Fig. 33 – 37)

- Fragment of epicarp in surface view showing striated cuticle.
- Fragment of vittae composed of polygonal, thin walled cells showing slight thickness at the corners.
- Sclereids of the mesocarp which are irregular shaped; ovoid – elongated, rectangular with sinuous outline; moderately thick walled with numerous well marked pits.
- Fragment of endocarp in surface view showing thin walled elongated cells arranged in groups with their long axes parallel to each other.
- Fragment of moderately thick walled cells of the endosperm filled with oval – round aleurone grains and microspheroidal crystals of calcium oxalate.

10. Zeera Siyah

Botanical Name : *Carum carvi* Linn.

Family : Apiaceae

Part used : Fruit

Action : Astringent, carminative, stomachic, diuretic, expectorant, anthelmintic.

Therapeutic used : Leucoderma, dysentery, abdominal tumors, used as poultice for painful and protruding piles.

Important formulations	:	Habb-e-Jund; Habb-e-Pachnola; Habb-e-Ibn-e-Haris; Iksier-ul-Atfal; Majoon-e-Kalkatanej; Majoon-e-JograjGugal; Majoon-e-Suranjan; Majoon-e-Niqras; Majoon-e-Nankhwah; majoon-e-Yahya Bin Khalid; Jawarish Kamooni;Ayarij-e-Shabyar; NamakAjeeb; NamakSulemani; Safoof-e-Muqliyasa; Safoof-e-Moya; SafoofMuhazzil.
Powder study	:	Colour : Fawn and brown Odour : Pungent; characteristic Taste : Astringent
Identifying features	:	(Fig. 38 – 40) • Fragment of vittae composed of thin walled cells; polygonal in surface view. • Sclereids of mesocarp*;* present either single or in groups. • Sclereids rectangular to sub rectangular; thick walled with well marked pits. • Pieces of spiral and annular vessels.

Figures 1 – 40 : Microscopic profile of the herbal drugs investigated

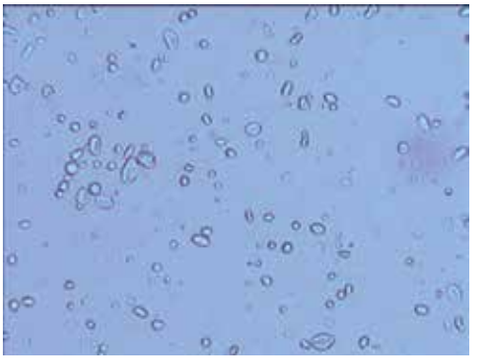

Fig. 1 x40 Starch grains of Asl-us Soos

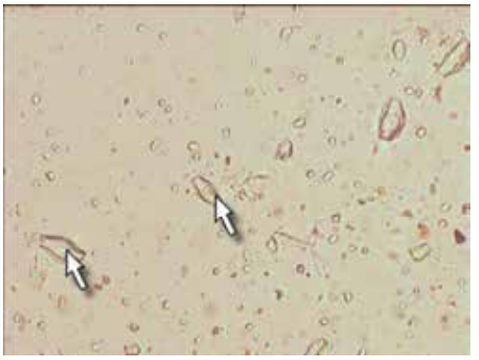

Fig. 2 x40 Crystals in Asl-us-Soos

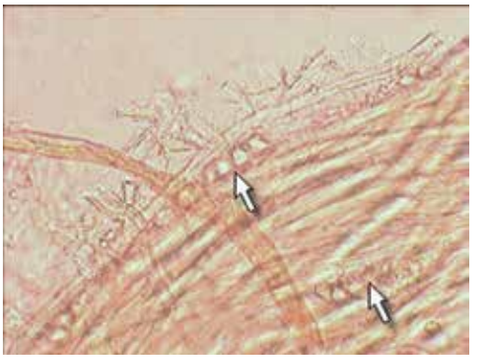

Fig. 3x40 Fibres with calcium oxalate prism sheath in Asl-us-Soos

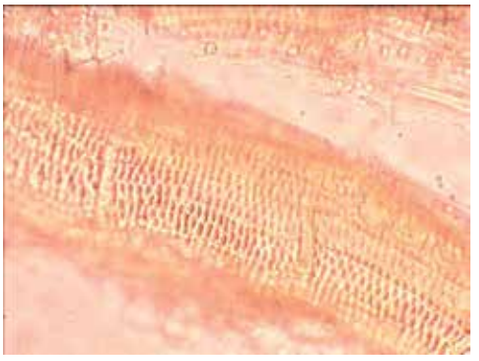

Fig. 4 x40 Pitted vessels in Asl-us-Soos

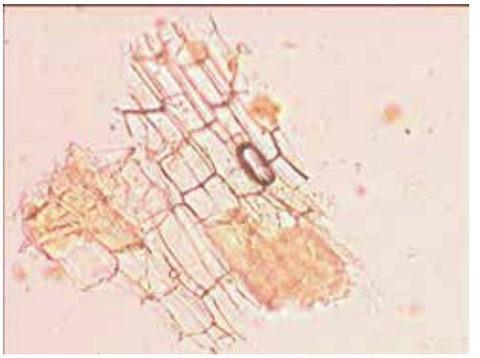

Fig. 5x40 Cork cells in Balchar

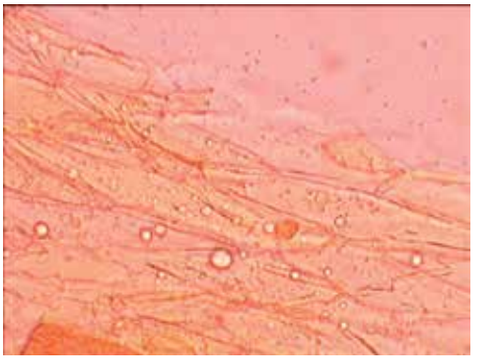

Fig. 6 x40 Parenchyma cells containing oil globules in Balchar

Fig. 7 x40 Reticulate vessels in Balchar

Fig. 8 x40 Piece of fibre in Balchar

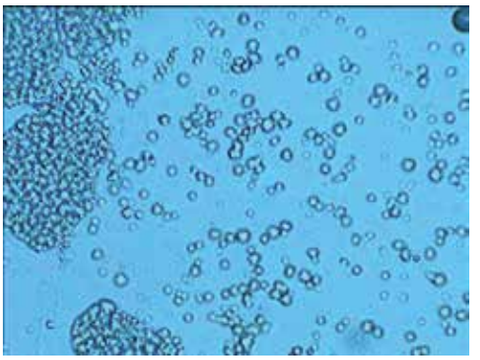

Fig. 9 x40 Starch grains in Musli Siyah

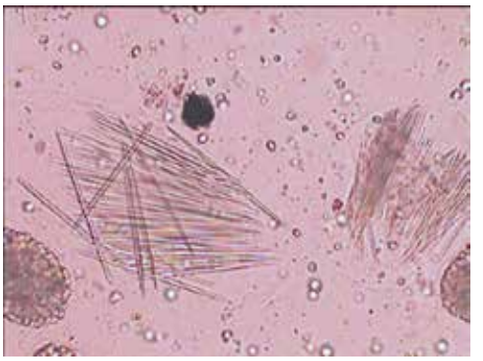

Fig. 10 x40 Acicular crystals in Musli Siyah

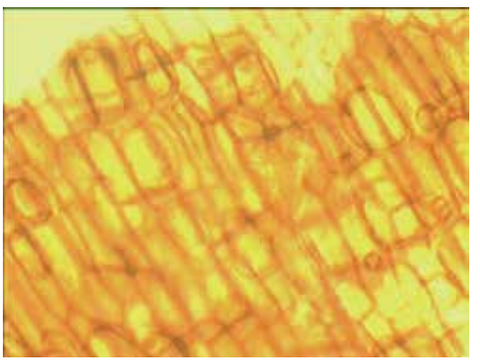

Fig. 11 x40 Cork cells in Musli Siyah

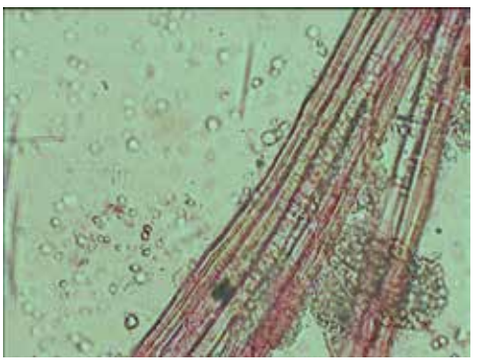

Fig. 12 x40 Fibres in Musli Siyah

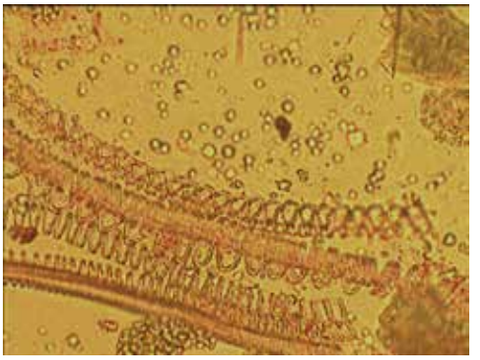

Fig. 13 x40 Vascular elements in Musli Siyah

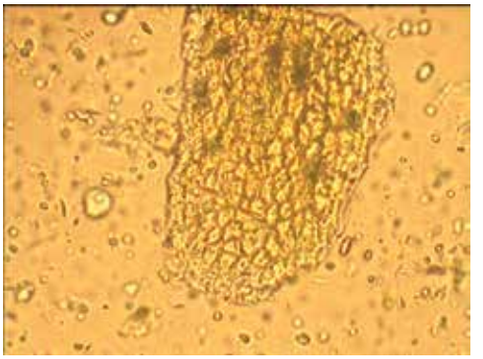

Fig. 14 x40 Fragment of epicarp of Post-e- Halela Kabli

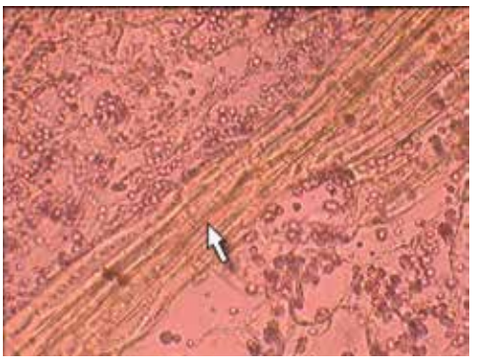

Fig. 15 x40 Fibres in Post-e-Halela Kabli

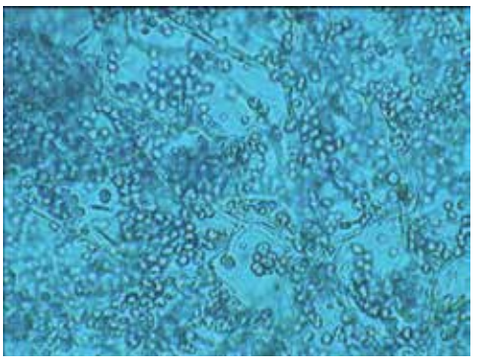

Fig. 16 x40 Starch grains in Post-e-Halela Kabli

Fig. 17 x40 Sclereids in Post-e-Halela Kabli

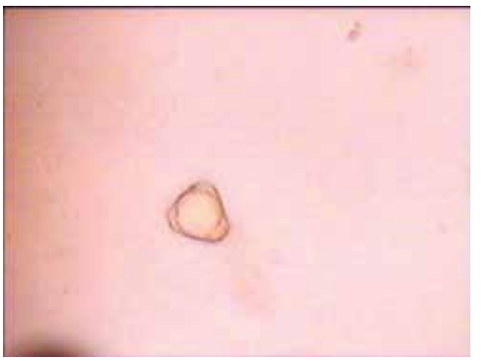

Fig. 18 x100 Pollen grain of Qaranfal

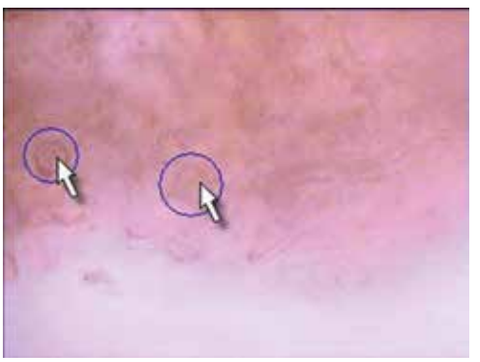

Fig. 19 x100 Crystals in Qaranfal

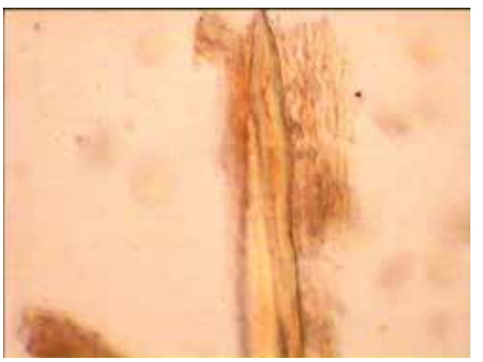

Fig. 20 x40 Piece of fibre in Qaranfal

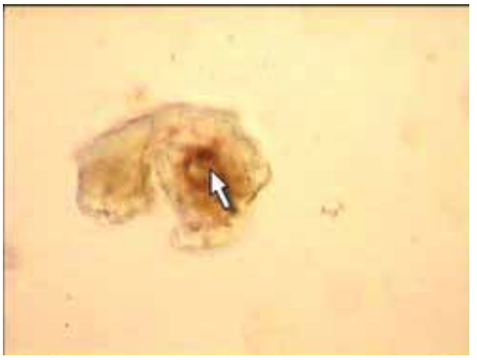

Fig. 21 x40 Oil cavity in Qaranfal

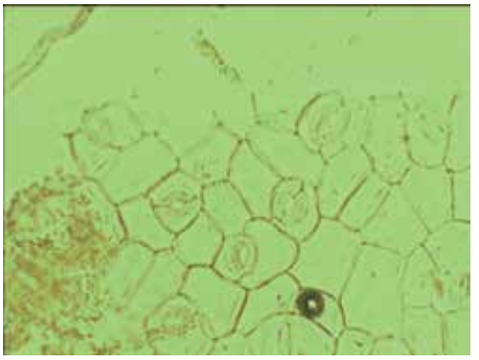

Fig. 22 x40 Epidermal cells showing stomata in Sana Leaf

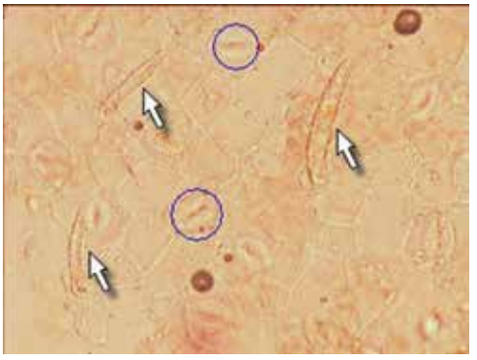

Fig. 23 x40 Epidermal cells showing stomata & Non glandular trichome in Sana Leaf

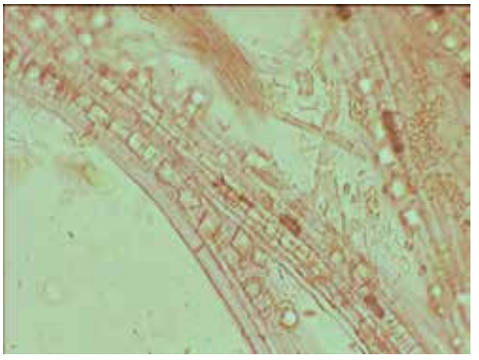

Fig. 24 x40 Fibres surrounded by calcium oxalate prism sheath in Sana Leaf

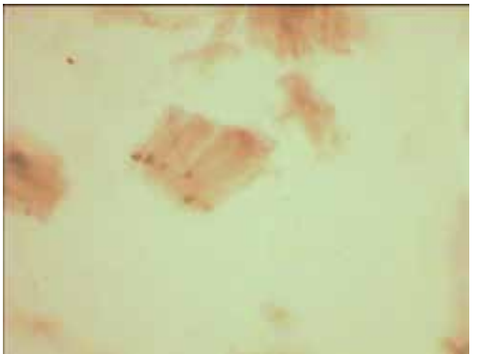

Fig. 25 x40 Palisade cells in Sana Leaf

Fig. 26 x100 Vascular elements in Sana Leaf

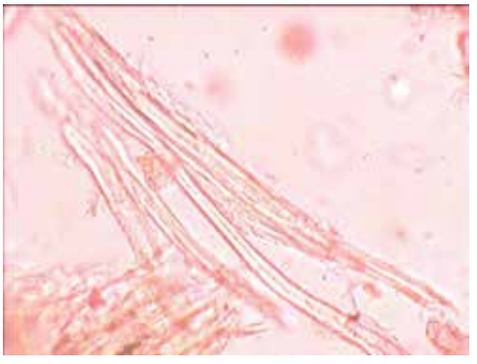

Fig. 27 x40 Fibres in Sandal Safaid

Fig. 28 x40 Pitted vessels in Sandal Safaid

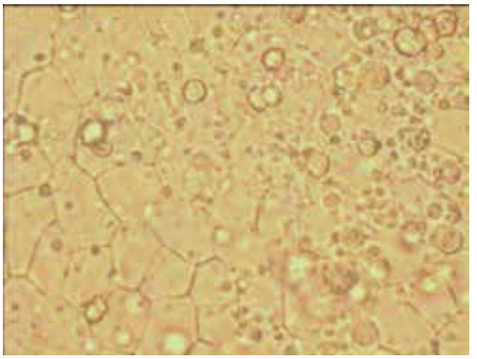

Fig. 29 x40 Parenchyma cells showing oil globules in Sandal Safaid

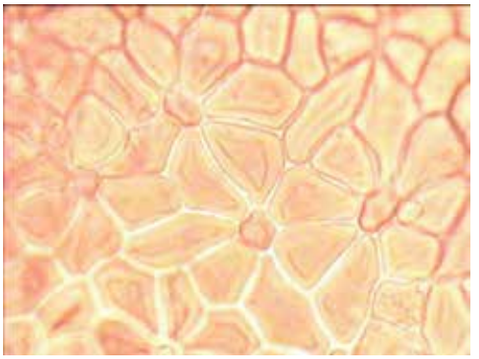

Fig. 30 x100 Fruit wall showing cictrices in Sumaq

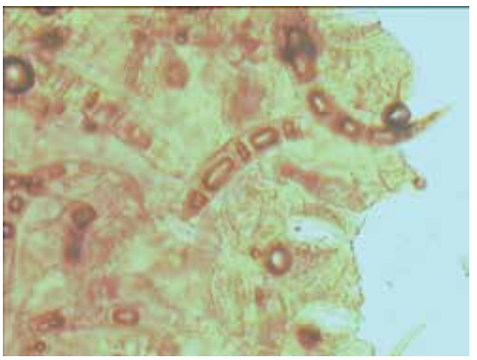

Fig. 31 x40 Fruit wall showing trichomes in Sumaq

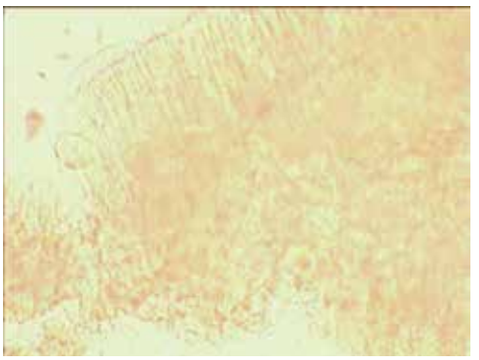

Fig. 32 x40 Palisade cells and endosperm cells filled with oil globules in Sumaq

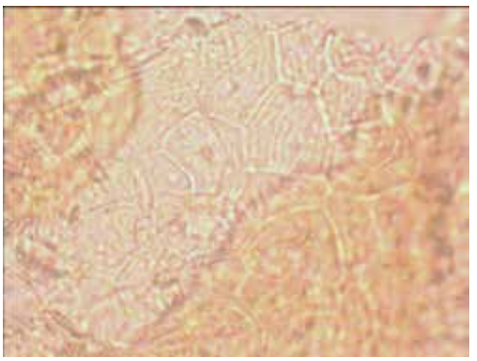

Fig. 33 x100 Cells of epicarp showing striated cuticle in Tukhm-e-Karafs

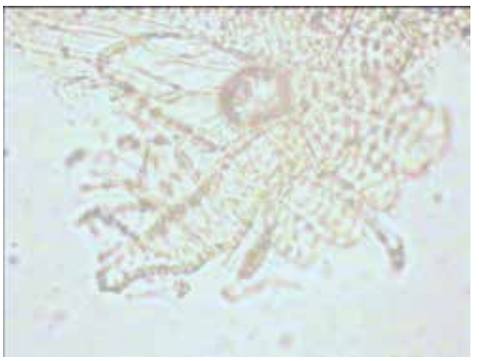

Fig. 34 x100 Sclereids of mesocarp in Tukhm-e-Karafs

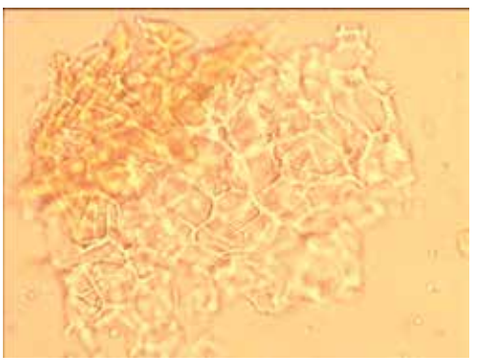

Fig. 35 x40 Fragment of vittae in Tukhm-e-Karafs

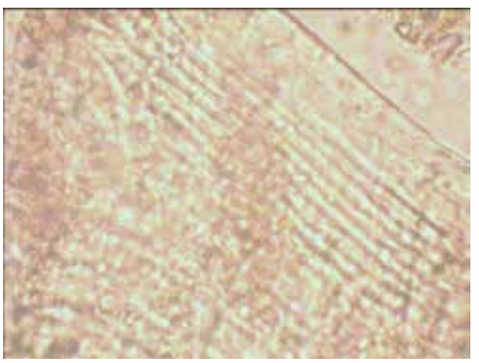

Fig. 36x100Fragment of endocarp in Tukhm-e-Karafs

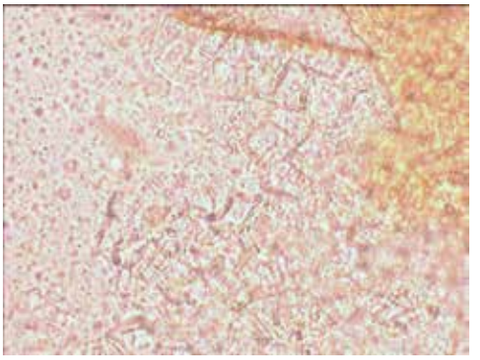

Fig. 37 x40 Endosperm cells showing oil globules and crystals in Tukhm-e-Karafs

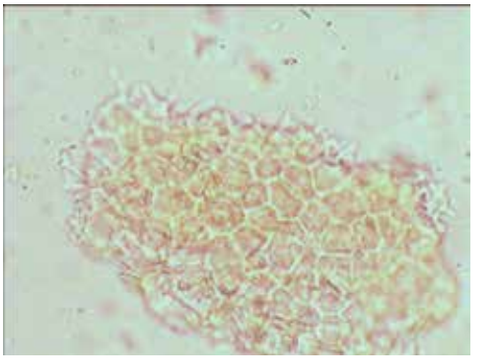

Fig. 38 x40 Fragment of vittae in Zeera Siyah

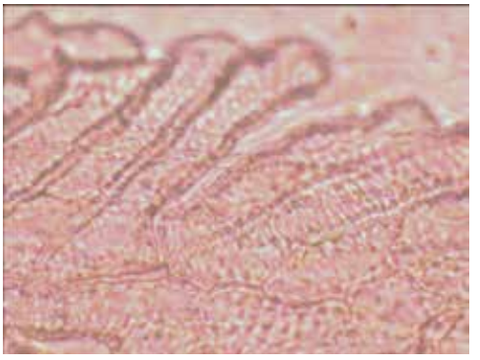

Fig. 39 x40 Sclereids of mesocarp in Zeera Siyah

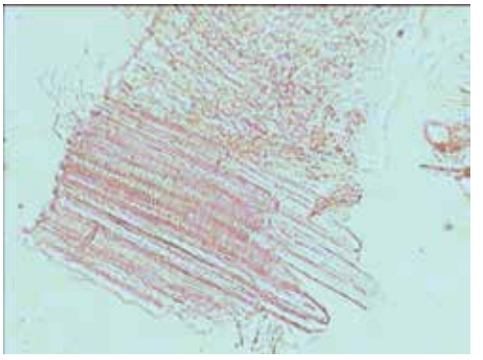

Fig. 40 x40 Vascular elements in Zeera Siyah

Conclusion

Microscopic analysis of powdered herbal drugs is essential. This analysis helps in identification of the correct drug sample and detection of its possible adulterants. The present work on ten important herbal drugs used in Unani and Ayurvedic systems of medicine, provides different tissues of diagnostic value and hence will be useful for academicians, researchers, drug testing laboratories, health professionals and regulatory authorities, herbs base pharmaceutical industries, crude drug dealers, and those who are engaged in identification and standardization of crude drugs.To ensure identification of the medicinal plant, microscopic analysis need to be supplemented with physico-chemical analysis of the plant material as well.

Acknowledgements

The authors are deeply indebted to Director General, CCRUM, New Delhi, for providing necessary research facilities and encouragement, for the present study.

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Management of Deep Vein Thrombosis (DVT) by Leech Therapy : A Case Study

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Abstract

We are reporting a case of 33-year-old female presented to Regional Research Institute of Unani Medicine, Aligarh, OPD with complaints of swelling and pain in left leg with inability to walk properly since one week. On the basis of signs and symptoms she was diagnosed to be suffering from Deep Vein Thrombosis (DVT). Color Doppler ultrasound showed thrombosis of Left Common Iliac vein. Thrombus was seen proximal to distal IVC, extending to common femoral, superficial femoral and the poplitial veins. Leech therapy was applied weekly for a month and the patient was examined at every visit.

Leech application was found effective as there was marked improvement in pain, swelling, and tenderness. The thrombus was found to be removed from the venous circulation. No major or minor side effect was observed during the course of study as was evident from biochemical and haematological findings. Thus the leech application was found to be effective and safe in the management of DVD.

Keywords: Deep Vein Thrombosis (DVT), Leech therapy, Unani Medicine.

Introduction

Deep Vein Thrombosis (DVT) is one of the causes of maternal morbidity and mortality. Its incidence is about 1 per 1000 deliveries, of which 1-2% is fatal. In pregnancy, the risk of DVT increases by 5-10 times (Srivastva, 2015). DVT is a common vascular condition that arises from the formation of a blood clot within the deep veins of the circulatory system. Venous thrombosis is the result of occlusive clot formation in the veins. It occurs mainly in the deep veins of the leg (Deep vein thrombosis, DVT), from which, parts of the clot frequently embolizes to the lungs (pulmonary embolism, PE). Venous thrombosis is common and often occurs spontaneously, but it also frequently accompanies other medical and surgical conditions.

DVT is the third most common vascular disease after ischemic heart disease and stroke. The mechanism underlying DVT, known as Virchow's triad, are venoustasis, hypercoagulablity and endothelial injury. It is a life threatening condition if complicates into pulmonary embolism due to dislodgement of thrombus loosely attached to the vessel wall. The common signs and symptoms of DVT include sudden swelling of an extremity, redness or discoloration of the skin, warmth of the affected area, pain that may exacerbate with exercise but does not disappear with rest, low-grade fever, and tachycardia. Homan's sign is a rapid discomfort in the calf muscles on forced dorsiflexion of the foot with the knee straight. Although this may be suggestive of DVT, it is not consistently

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present in all patients with DVT and may be indicative of other diseases in the lower extremities (Galanaud, 2014).

Leech therapy has been used in Unani system of medicine since centuries for the purpose of *Istifragh* (to drains impure blood). It is considered a unique and effective method of bloodletting. Leech therapy works on the principles of *Tanqiya-e- mawad* (evacuation of morbid humors) and *Imala-e-mawad* (diversion of humors). *Tanqiya-e-Mawad* means the resolution and excretion of morbid humors and excess fluids from the body, thereby maintaining the homeostasis in the quality and quantity of four humors found in the body, which are actually responsible for the maintenance of normal health. *Imala-e- mawad* refers to the diversion of the morbid fluids from the site of affected organ to the site where from it is easily expelled out of the body tissues. Based on this holistic approach, *Unani* physicians have been widely using this therapeutic regimen for a number of diseases. The effectiveness of this therapy may be attributed mainly to the *Mussakkin* (sedative) and *Muhallil* (anti-inflammatory) actions of saliva of leeches (Jurjani, 1903; Kosta, 2014; Maseehi, 1986; Razi, 1991; Alam *et al*., 2016).

Case Study

A female patient, K. Begum, aged 33 years, housewife, mother of 3 children, living in Aligarh, UP, India, visited OPD of RRIUM, Aligarh and registered with registration no 2016/Jan/01374 on 09.01.2016. She had the complaints of severe pain in left leg, swelling over the leg and inability to walk properly since one week. Nine days ago, she had delivered her third child.

According to the patient's statement, she had developed swelling, pain, tenderness, edema and redness in the left lower limb after 3rd day of delivery. It was found that the pain was constant, aching in nature, not radiating to any other part, aggravated on standing and relieved by elevation of leg. She had no personal or family history of thromboembolism, hypertension, diabetes mellitus, trauma or any previous surgery. On examination, she looked unwell but temperature (36.8 0C), BP (128/90 mmHg) and heart rate etc were within the normal limits. She had never taken contraceptive pills.

On examination, left upper thigh was found warm and swollen. Tenderness was present on calf region. Redness and oedema in lower limb were also present. Homan's sign (On Dorsiflexion of foot, patient complained of pain in calf region) was positive. Moses' sign (Pain, when calf muscle is compressed forward against the tibia, but not when the calf muscle is compressed from side to side) was also positive.

On the basis of above sign and symptoms it was diagnosed that she was suffering from DVT. Color Doppler study of left leg brought out the following findings:

- Left Common Iliac vein was thrombosed and the thrombus was seen proximal to distal IVC and distally it was extending to common femoral, superficial femoral and the poplitial veins.
- The thrombus was found extending to sephano-femoral junction.
- Distal deep veins were partially potent and compressible.
- Flow in deep veins of the calf was not seen normally.

The above findings confirmed Deep Vein Thrombosis (DVT).

The patient was then registered at RRIUM, Aligarh, OPD for leech therapy. Biochemical and haematological investigations were done on day 1 before starting the treatment and after 4 weeks at the end of treatment. All the findings were found within the normal limits except the haemoglobin which amounted only to 8.4 g/dl.

Bleeding and clotting time were also determined to exclude the bleeding disorder, if any. In urine examination, traces of pus cells and epithelial cells were found.

Treatment

After taking written consent from the patient the leech therapy was started. It was done weekly for a month along. Ten ml of Sharbat Faulad, a Unani formulation prepared by Dawakhana Tibbiya College, AMU, Aligarh was also given orally twice after meals to increase hemoglobin.

The patient was examined weekly. The area where leech was to be applied was washed with soap and water and was dried with sterile cotton. The appropriate leeches were taken in a bowl filled with water. To enhance the appetite of leeches for blood, a small amount of fine turmeric powder was added to the water. The active leeches were selected and transferred to another tray having clean water. Using all aseptic procedures, 6 fresh leeches were applied over the left thigh on anterior and antero-medial regions by picking up with the help of thumb and index finger using gauze pieces (Fig 1 & 2). Over a period of approximately 30 minutes leeches sucked sufficient amount of blood and left the site spontaneously. Two leeches still sticking to the site were removed manually. A sprinkle of turmeric powder around the mouth of leech helped in manual removal.

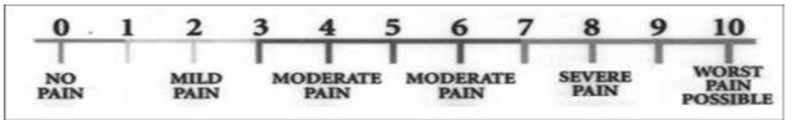
Patient reported after one week with reduced pain, while the swelling over the thigh was found subsided significantly. On 2nd visit, 3 leeches were applied on poplitial region (back of the thigh) and 2 leeches on posterior aspect of left leg (Calf) following the procedure described as above.

On 3rd visit, 5 leeches were applied on calf area (Fig 4), while on 4th visit, 3 leeches were applied on dorsum of left foot (Fig 5 & 6).

On every visit, leeches were allowed to suck blood till they were belly filled and fell down by themselves (Approximately 30 minutes). The patient was kept in observation for 2 hrs post leech therapy. Then, antiseptic dressing was applied on the site of leech application.

Assessment Criteria

Assessment was done clinically, by Color Doppler study and digital photography. Clinical assessment and digital photography was done on every follow up to assess the result. Patient was assessed weekly on the basis of Numeric Pain Rating Scale (NPRS). After every session of leeching, her pain and swelling were found to be subsided gradually.

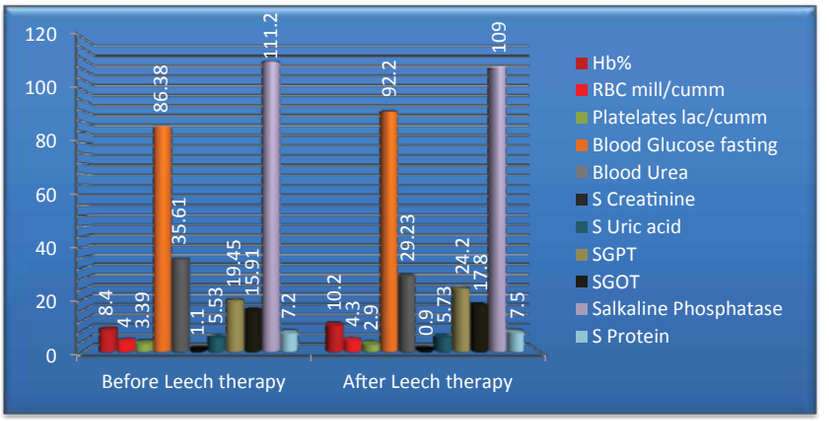


Numeric Pain Rating Scale

By the above data as shown in NPRS table, it was observed that before the application of leech therapy, the grade of pain was 9. After 1 week of the treatment, it came down to 7. Further on the completion of 2nd, 3rd, and 4th weeks the grades of pain were recorded as 5, 3 and 1, respectively.

Before leech therapy, patient was having swelling on left leg which later subsided completely in 3 weeks. Gradual improvement in walking over a period of 4 weeks was also observed. Initially the patient was unable to walk on her own. After first session of therapy, she was able to walk a distance of 25 meters whereas after 2nd, 3rd, and 4th week, she was able to walk the distance of 50, 90 and 200 meters, respectively.

The biochemical and haematological investigations including Blood Glucose Fasting, Blood Urea, Serum Creatinine, Serum Uric acid, SGPT SGOT, Serum Alkaline Phosphate Serum Protein, Haemoglobin, TLC, DLC, Polymorphs Lymphocytes, Eosinophils Monocytes Basophils, Total RBCs Platelets count 2.90 were repeated at the completion of treatment and were found again within the normal range indicating the safety of the treatment. The haemoglobin which was little low in pretreatment investigation increased significantly to 10.2 g/dl (Graph 1).



Graph 1: Haematological and Biochemical Investigation Chart-1

After completion of leech therapy, Color Doppler imaging of left leg was again conducted for comparison with the previous one. The following findings were observed:

Lt Common Iliac vein was partially thrombosed and the thrombus was seen proximal to initial part of iliac vein and distally it was extended to common femoral, superficial femoral and the poplitial vein. The thrombus was however found to partially filling the lumen and the flow through the lumen was seen to be adequate.

- The thrombus is not extending to sephano-femoral junction.
- Flow in deep veins of the calf was seen normally.
- There is no cutaneous edema over the Lt lower limb.

The findings of Color Doppler suggested that the condition improved significantly after leech therapy. Patient was advised to follow up after 1 month. At the subsequent follow up, it was observed that she had no swelling or pain in the left lower extremity and had no problem in walking or movement. The leg appeared almost normal (Fig 7).

Figure 1

Figure 2

Figure 3

Figure 4

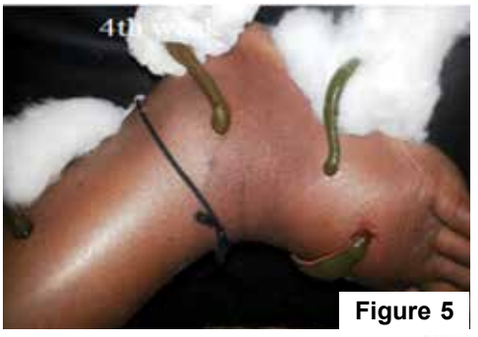


Figure 5

Figure 6

Figure 6

Discussion

The aim of leech therapy in deep vein thrombosis was to reduce the morbidity by a natural and safe alternative healing procedure that has no side effect. Once the leeches attach themselves to the skin of the patient and start sucking blood, the saliva enters the punctured site along with enzymes and chemical compounds which are thought to be responsible for the amelioration of the pathological condition.

The important factors that make leech therapy an effective treatment in deep vein thrombosis are the pharmacologically active components present in leech

saliva. The leech saliva contains pharmacologically active substances, such as the thrombin inhibitor hirudin, apyrase as well as collagenase, hyaluronidase, factor Xa-inhibitor, fibrinase I & II. These agents are attributed to possess anticoagulant, thrombolytic, anti-inflammatory and anaesthetict effects etc that directly or indirectly help improve the DVT. The leech saliva also contains calin, which inhibits blood coagulation by blocking the binding activity of von Willebrand factor with collagen and also inhibits collagen mediated platelet aggregation. It also contains destabilase, which shows monomerising activity that dissolves thrombi and thus produces thrombolytic effects eventually preventing congestion within the veins (Rigbi *et al*., 1996 and Kosta, 2014).

Because of anti coagulating agents, the blood coagulation is checked and hence it flows freely through the vessels. The anti coagulating agents also dissolve clots in the vessels, eliminating the risk of it travelling to the other parts of the body and blocking an artery or vein. The vasodilating agents present in saliva widen the vessel walls by dilating them; it further causes the blood to flow without obstruction. Patients feel relieved by the anti inflammatory and anesthetic effects of the leech's saliva.

The saliva of the medicinal leech also contains proteinase inhibitors, such as bdellins, eglin, inhibitors of α-chymotrypsin, subtilisin, and the granulocytic neutral proteases-elastase and cathepsin G, responsible for the anti-inflammatory effect of leeching (Bhandare *et al*., 2013).

Conclusion

It was concluded that leech therapy is effective in the management of deep vein thrombosis. It may be further investigated for its important therapeutic potential in a larger group of patients. A reproducible result will pave the way for development of effective, safe and low cost therapeutic regimen.

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Evaluation of Diuretic Activity of Hydro-alcoholic Extract of Bisehri Booti plant (*Aerva lanata* Linn.)

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Abstract

The diuretic activity of hydro alcoholic extract of Bisehri Booti (*Aerva lanata* Linn) plant was studied on healthy albino rats of Wistar strain. The animals were kept on fasting for 18 hours; thereafter they were administered normal saline (25 ml/kg) orally and divided into four groups of six animals each. Animals in group I-IV were treated with distilled water (5 ml/kg), furosemide (20 mg/kg) and 150 mg/kg and 300 mg/kg of hydro alcoholic extract of Bisehri Booti, respectively once daily. After respective treatment all the animals were kept separately in metabolic cages and urine passed during 6 hours was collected in a measuring tube. In standard control and two test groups the urine volume and the urinary sodium and potassium, chloride concentration was found increased significantly when compared with plain control group. The study demonstrated that hydro alcoholic extract of Bisehri Booti (*Aerva lanata* Linn) in a dose of 300 mg/kg has significant diuretic activity.

Key words : Bisehri Booti, Furosemide, Diuretic activity, Hydro-alcoholic extract.

Introduction

Bisehri Booti (*Aerva lanata* Linn.) a less known Unani drug belonging to family Amaranthaceae (Afaq *et al*., 1991). It is an erect or prostate, hoary tomentose herb found throughout tropical India (Anonymous, 1985). The flowering time of *Aerva* species is August to October. It is used mainly in haematuria, albuminuria, burning micturation and other urinary and nephrological disorders by *Tabeebs* (Unani practitioners) of Western Uttar Pradesh successfully. However, it has not been mentioned in important works related to Advia or Moalijat. Only Hkm. Abdul Qadir (Qadir, 1930) has mentioned this drug in his book Mujarrabat-e-Qadri. He has given a brief but comprehensive account of its efficacy in the diseases of urinary system.

Bisehri Booti was used in the Indian folk medicine for the treatment of urinary problems, over insect bitten site to ease pain, to relive toothache and as hepato-protective, antihelminthic, anti diarrhoeal, anti- calculus etc (Battu and Kumar, 2012). In east and west Godavari of Andhra Pradesh the root decoction is used in conditions like albuminuria in children (Nagaratna *et al*., 2014). The whole plant of Bisehri Booti (BB) has been described to be used as diuretic, anti-inflamatory, litholytic, nephro-protective action while the aerial parts are used as anthelminthic (Rajesh *et al*., 2010). The fresh root (about 9 cm) was used as a stick for inducing abortion by the *Lodha* tribes. The medicine man suggested that this processes of abortion is effective for terminating pregnancy up to 4 months only (Kaur and Mehta, 2014). BB in Ayurveda has been described to possess diuretic with

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anti-inflamatory, anti-helminthic, antiparasitic, cytotoxic, anti-hyperglycemic, anti-hypoglycemic, anti-hyperlipidemic, nephroprotective, hepatoprotective, demulcent, anti-bacterial and mild analgesic effects. It is used in the treatment of lithiasis, cough, asthma and headache and as an antidote for rat poisoning (Indukuri *et al*., 2013).In traditional and folklore medicine though it has been described to be effective in many diseases but it is more commonly used to manage the ailments of urinary sytem mainly for diuretic and nephroprotective effect. The present study was designed to study the diuretic effect of its hydroalcoholic extract in albino rats.

Material and Methods

Collection of Plant material

The whole plant of BB (*Aerva lanata*, juss) was collected from the collage lawn of Ajmal Khan Tibbiya Collage, Aligarh Muslim University Aligarh. Its identity was confirmed by the Pharmacognosy section of the department of Ilmul Advia AKTC, AMU Aligarh. A Voucher specimen (SC-0140/13S) of the plant material has been submitted in the museum of Department of Ilmul Advia, Faculty of Unani Medicine, AMU, Aligarh for the purpose of record and future reference.

Preparation of extract

The whole plant was first dried in shade and then in hot air oven below 40ºc. The dried plant was powdered with the help of an electric grinder. This powder was used to prepare the extract. 100 gm of powder was extracted in 400 ml of hydroalcoholic solvent (50% ethanol and 50% water) by Soxhlet's apparatus. The temperature was maintained between 70-80ºc for 6 hours. There after the liquid extract was collected, cooled and filtered by Whatman filter paper No 41 and then placed on a water bath at a temperature of 60-70ºc until the entire solvent evaporated. The extract was then weighed and the yield percentage was calculated with reference to the crude drug. The calculated yield was found to be 20% w/w.

Dosage of the drug

The dose of the crud drug was calculated by multiplying the Unani clinical dose of BB by the conversion factor of 7 (Freireich *et al*. 1966) and was found to be 700 mg /kg. The dose range of BB has been mentioned in Unani Literature as 3-5 gm. However, we selected the optimal quantity of 5 gm because it has been reported that Unani drugs failed to produce desired response on the low dose in various experimental studies (Amin, 1998). Further a second dose of 1400 (doubled dose) was also used to study the dose dependent effect of the test drug.

The dose of extract (20%) was calculated as 150 mg/kg. The extract in the dose of 150 mg/kg and 300 mg/kg (doubled) were suspended in distilled water (0.5 ml-1ml) when it was intended to be used to treat the animals. A feeding canula was used to administer the suspension which was homogenized by shaking well for a minute or so.

Animals

Wistar Albino rats weighing 150-200 gm of either sex were used for the study. The animals were kept in animal house of the department of Ilmul Advia in polypropylene cages with 12 hours light and dark cycles, temperature (23±2 ºC) and humidity (55±15%). was maintained throughout the study. The animals were fed a balanced commercial pellet diet and water *ad libitum* and were acclimatized for 7 days before the start of the experiment.

Drugs and Chemicals

Tab. Furosemide 20 mg (Batch No. 0214558) was procured by Sanofi India Limited, 3501, 3503-15, 6310 B-14 G.I.D.C. Estate, Ankleshwar-393002. Sodium and Potassium kit (Lot No. RELY 2011) was procured from Coral Clinical System, Plot No. 86, Sector 7,II E, Sidcul, Pantnagar, U.S. Nagar. Uttarakhand, India. Chloride kit (Lot No. CLR1158) was procured from Bldg. 'D', Plot No. M-46, Phase III B, Verna Industrial estate, Verna, Goa, India.

Diuretic Activity

The concentrated hydro alcoholic extract of BB was evaluated for diuretic activity according to the method of Lipschitz et.al. (1943) and Tylor and Toplis (1962). Albino rats of Wistar strain of either sex were divided into four groups of six animals each. The animals were deprived of food and water 18 hours prior to the experimentation. All the animals were hydrated with normal saline (0.9% Nacl) at a dose of 25 ml/kg orally. Group I served as control while the other three groups received either the standard drug frusemide (20 mg/kg), orally, (dissolved in 1 ml distilled water) or the test drug (150 & 300 mg/kg), orally, (dissolved in 1 ml distilled water) after 30 minutes of saline administration and served as Test group A and B, respectively Immediately after the treatment with test and standard drug all the animals were kept separately in metabolic cages. The mineral oil (Paraffin oil) was applied on the upper surface of the bottom of the metabolic cages. A glass funnel kept under the metabolic cage, was also lubricated with the mineral oil. The purpose of application of mineral oil was the prevention of urine loss through evaporation. Urine was collected after 6 hours of the treatment. Further, the bladder was emptied by pulling the base of the tail of each animal (Radhika *et al*., 2010).

Urine Analysis

The parameters observed were total urine volume and the concentration of sodium, potassium and chloride excreted in it. The concentration of sodium, potassium and chloride were determined by using flame photometer (AIMIL Photoetectric Instrumentation Pvt. Ltd.), through specific kits.

Statistical Analysis

The parameters mentioned above were assessed in all the groups and the finding were expressed as mean ± SEM. The different values analysed statistically using one way ANOVA Statistical difference was considered significant at $p<0.05$.

Observation and Results

In plain control group, the mean volume of urine was found to be 1.02±0.175 ml, while in standard control it increased significantly to 2.20±0.810 ml ($p<0.001$). In the test group A and B, the volume of urine collected during six hours increased significantly to 1.5±0.258 ml, 3.1±0.208 ($p<0.001$), respectively when compare with plain control. The mean sodium level in plain control was found to be 97.00±3.41 mmol/l. In case of standard control, test group A and B, sodium level were found to be 131.50±3.30 mmol/l ($p<0.001$), 112.00±1.82 mmol/l and 143.75±6.61 mmol/l ($p<0.001$), respectively. The concentration of potassium was calculated to be 71.22±0.58 mmol/l in plain control group, whereas in standard control, test group A and B, it was found to be 108.19±0.72 mmol/l ($p<0.001$), 92.25±1.75 mmol/l ($p<0.001$) and 114.23±0.58 mmol/l ($p<0.001$), respectively. In plain control group, the level of chloride was found to be 70.41±0.35 mmol/l, while in standard control, test group A and B, chloride level was found to be 93.12±0.83 mmol/l ($p<0.001$), 76.50±2.50 mmol/l ($p<0.05$) and 113.16±0.47 mmol/l ($p<0.001$) respectively (Table 1, Fig. 1&2).

Table 1: Diuretic activity of hydro alcoholic extract of Bisehri Booti (*Aerva lanata* Linn)

Groups	Urine volume (ml)	Sodium (mmol/l)	Potassium (mmol/l)	Chloride (mmol/l)
Plain control: D/W (1ml/kg)	1.02±0.175	97.00±3.41	71.22±0.58	70.41±0.35
Standard control: Bisehri Booti (20mg/kg)	2.20±0.810***	131.50±3.30***	108.19±0.72***	93.12±0.83***
Test group A: Bisehri Booti (150mg/kg)	1.5±0.258 ns	112.00±1.82ns	92.25±1.75***	76.50±2.50*
Test group B: Bisehri Booti (300mg/kg)	3.1±0.208***	143.75±6.61***	114.23±0.58***	113.16±0.47***

*p<0.05, **p<0.01, ***p<0.001; values expressed as Mean ± S.E.M.; N=6 in each group

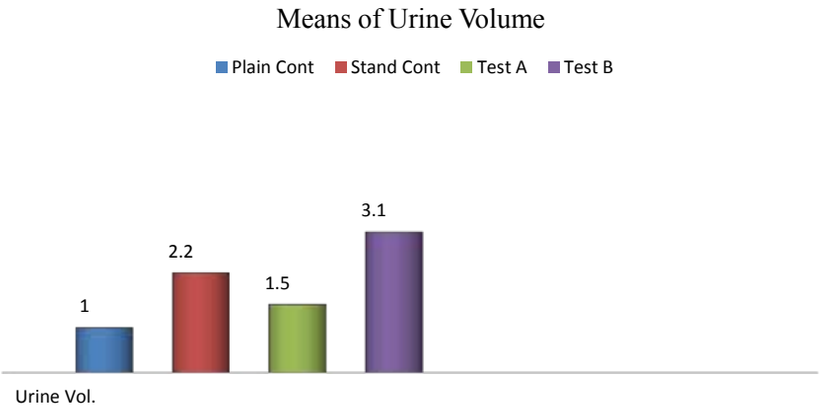

Fig 1: Effect of Bisehri Booti extract on mean urine volumes

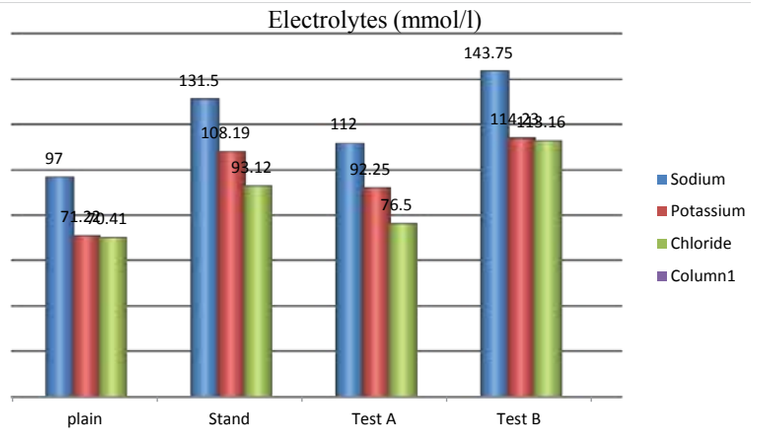

Figure 2: Effects of Bisehri Booti extract on means of urine electrolytes

Discussion

Diuretics are the drugs which increase the rate of urine flow, sodium, potassium and chloride excretion, and are used to adjust the volume and composition of body fluid in a variety of clinical conditions. The findings indicated that BB produced significant diuretic, caliuretic and natriuretic effect. The effect was though found to be dose dependent but only higher dose produced significant effect. This important pharmacological attribute may be the reason for its use in different disorders associated with urinary system such as oedema, haematuria, burning micturation, albuminuria and lithiasis etc. It was interesting to note that high dose of BB produced significantly more effect than the standard drug indicating its high therapeutic value.

Diuretics are frequently used to relive pulmonary congestion and peripheral oedema. They are also useful in reducing the syndrome of volume overload, decreasing cardiac workload, oxygen demand and plasma volume and thus help decrease the blood pressure (Hoeland *et al*., 2000). The control of plasma

sodium is important in the regulation of blood volume and its pressure, and the control of plasma potassium is required to maintain proper function of cardiac and skeletal muscle (Guyton *et al*., 1998). The loss of potassium increases when sodium reaches the collecting duct indicating decreased absorption of sodium in earlier part of nephron as occurs with thiazide and loop diuretics. A significant increase in the concentration of Na+ and K+ apart from indicating the relationship between the two also points towards the likely mechanism of action of the test drug (Harvey, *et al*., 2006). Thus the study indicated that the diuretic effect of BB may be caused by the action at the thick ascending limb like furosemide and / or at distal convoluted tubules like the thiazides. The regulation of sodium potassium balance is also intimately related to renal control of acid base balance. The test drug by increasing the urine volume and inducing natriuretic and kaliuretic effect clearly indicated that it has wide therapeutic potential and can be used in a number of acute and chronic renal and other diseases such as pulmonary oedema, ascites, portal hypertension, splenomegaly, congestive heart failure, nephrosios, nephritic syndrome and many other diseases etc.

BB contains various phyto-constituents like steroids, alkaloids, terpenes, flavonoid compounds and saponins etc (Afridi, 1992). Many flavanoids, saponins and terpenes are known to possess diuretic activity (Chodera *et al*., 1991; Rizvi *et al*., 1980). It may be suggested that these phyto-constituents of the test drug might be responsible at least in part, for diuretic activity and that they may be active individually or synergistically. The study demonstrated that BB is though a less known drug but possesses interesting pharmacological effect and may be used in a number of pathological conditions. It is therefore warranted that BB should be investigated for all those effects described in traditional literature and also for the therapeutic effect for which it is used by traditional practitioners and folklore healers.

Conclusion

On the basis of the above findings, it can be concluded that hydroalcoholic extract of Bisehri Booti (*Aerva lanata* Linn.) possesses significant diuretic activity. Therefore it can be used in a number of renal diseases and in other volume overload related disorders.

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Standardization of Majoon-e-Hajar-ul-Yahood : A Unani Compound Drug Formulation

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Abstract

The fundamental purpose to fix-up pharmacopoeial standards is to control the quality of raw drugs and finished products of traditional medicines viz., Unani, Ayurveda and Siddha. Unani System of Medicine is playing a significant role in providing efficacious medicines to the needy masses.The increased use of Unani products in recent years and growth of these products industries has led to increasing concern about their safety. Quality of medicine is most important factor for its acceptability among the people. So there is much need to evaluate the pharamacopoeial standards to assure the quality of Unani drugs. The drug Majoon-e-Hajar-ul-Yahoodis acts as diuretic (*Muddir-e-Baul*) and lithotriptic (*Mufattit-ul-Hasat*). It is an important formulation being used in the ailments of renal calculus (*Hast-ul-Baul*),burning micturation (*Hiraqat-ul-Baul*), oliguria (*Qillat-e-Baul*) and vesicular calculus (*Hasat-e-Masana*). Present study was done to evaluate Majoon-e-Hajar-ul-Yahood which was prepared in different batches at laboratory scale using twelve raw ingredients on pharmacopoeial standards according to WHO using various scientific methods viz., physico-chemical, pharmacognostical, TLC/HPTLC.The evaluated standards shall help to lay down the pharmacopoeial standards for the drug Majoon-e-Hajar-ul-Yahood.

Keywords: Majoon-e-Hajar-ui-Yahood, Pharmacopoeial standards, TLC

Introduction

Several traditional medicines are being prepared from higher plants (WHO, 2005). These medicines have to fulfill the basic requirements of safety and efficacy (EMEA, 2005; WHO, 2002). Evaluation of pharmacopoeial standards for traditional medicines is the process to generate the definitive qualitative and quantitative standards which gives an assurance of quality, efficacy, safety and reproducibility. Good laboratory practices and good manufacturing processes play the important roles for providing the quality and efficacious traditional preparations to the needy masses (WHO, 2000). Evaluation of pharmacopoeial standards using physicochemical, pharmacognostical and WHO parameters provide a set of characteristics to a particular herbal medicine. They are important tools to validate the Unani formulations in scientific process (Kunle, 2012). Majoon-e-Hajar-ul-Yahood is used in the ailments of renal calculus (*Hast-ul-Baul*), burning micturation (*Hiraqat-ul-Baul*), oliguria (*Qillat-e-Baul*) and vesicular calculus (*Hasat-e-Masana*). Present studies are aimed to evaluate pharmacognostical, physicochemical, TLC/HPTLC finger print, heavy metals, microbial load, aflatoxins and pesticide residues for the drug Majoon-e-Hajar-ul-Yahood, in an effort to standardize this important Unani drug.

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Materials and Methods

The ingredients used in the preparation of drug Majoon-e-Hajar-ul-Yahood were procured from the local market and identified by experts (Anonymous, 2007, 2008 &2009). The specimens of all ingredients of the formulation were deposited in the museum of Drug Standardization Research Unit at Regional Research Institute of Unani Medicine, Chennai, The drug Majoon-e-Hajar-ul-Yahood was prepared as per the formulation composition given in NFUM, Part-I using 12 ingredients shown in Table 1 (Anonymous, 2006).

Table 1: Formulation Composition of Majoon-e-Hajar-ul-Yahood

S. No	Unani Names	Botanical/English Names	Part used	Quantity Used
1.	Hajr-ul-Yahood	Silicate of Lime	--	100g
2.	Kaknaj	*Physalis alkekengi* Linn.	Fruit	10g
3.	Asaroon	*Asarum europaeum* Linn.	Rhizome	10g
4.	Maghz-e-Tukhm-e-Kharbuza	*Cucumismelo* Linn.	Kernel	10g
5.	Tukhm-e-Gajar	*Daucus carota* Linn.	Fruit	10g
6.	Tukhm-e-Karafs	*Apium graveolens* Linn.	Fruit	10g
7.	Maghz-e-Tukhm-e-Qurtum	*Carthamus tinctorius* Linn.	Kernel	10g
8.	Anisoon	*Pimpinella anisum* Linn.	Fruit	10g
9.	Maghz-e-Tukhm-e-Tarbuz	*Citrullus vulgaris* Schrad.	Kernel	10g
10.	Maghz-e-Tukhm-e-Kaddu Shireen	*Cucurbita moschata* (Duch. ex. Lam.) Duch. ex. Poir.	Kernel	10g
11.	Maghz-e-Tukhm-e-Khiyar Daraz	*Cucumis melo* var. *utilissimus* Dulthie & Fuller	Kernel	10g
12.	Qand Safaid	Sugar	-	500g

Method of Preparation

All the ingredients taken were of pharmacopoeial quality. They were cleaned; dried and powdered (ingredients 1 to 3 and 5, 6, 8 of the formulation composition) and were sieved through 80 no. mesh and kept separately, while ingredients 4, 7 and 9 to 11 were powdered and sieved through 60 no. meshes and kept separately. QandSafaid (no. 12 ingredient) was dissolved in 500 ml of water on slow heat and 0.1% citric acid was added at the boiling stage and mixed thoroughly till consistency of 72% quiwam was obtained; after which 0.1% sodium benzoate was further added in the quiwam so formed, till consistency of quiwam reached to 78%. Vessel was removed from the fire and mixed powder of all the ingredients was added in the quiwam while in hot condition and mixed thoroughly to prepare the homogenous product. Finally, the finished drug formulation was allowed to cool at room temperature and packed in tightly closed containers to protect from light and moisture.

Powder Microscopy

Drug (5g) wasweighed, mixed with 50ml of water in a beaker and warmed gently inorder to make complete solution in water. Then mixture was centrifuged and supernatant was decanted, sediment so obtained was washed with distilled water. It was centrifuged again and decanted the supernatant; this cycle was repeated 4-5 times. After which a small quantity of the sediment was taken in watch glass and few drops of phloroglucinol and concentrated hydrochloric acid were added in the sample than it was mounted in glycerin for microscopic study. Various characters so observed were noted in different mounts following (Wallis, 1987 and Johansen, 1940).

Physico-Chemical Analysis

Physico-chemical parameters viz., moisture content, ash values, alcohol and water soluble extractives, pHvalue, bulk density and estimation of sugar were analyzed as per the standard method (Anonymous, 1987; 1998).

TLC/HPTLC finger print analysis

Preparation of Extracts for TLC

One sample of the drug from each of the three batches so formed (5g each) was extracted with 20 ml of chloroform and 20 ml of alcohol separately. Both the extracts were filtered and concentrated separately up to 10 ml in volumetric flask and were used for the TLC/HPTLC Finger Print Analysis.

The chromatograms of both the extracts were taken using the solvent systems toluene: ethyl acetate: formic acid (8:2:0.2) and toluene: ethyl acetate (1:1) for chloroform and alcohol extracts respectively. The plates were dried at room temperature and spots were observed at various wavelengths. The plates were scanned at 254 nm to record the chromatogram spectrum and then same plates were visualized at UV-366 nm and derivatized with spraying of vanillin-sulphuric acid reagent and heated at 105° C till appeared coloured spots (Wagner and Bladt, 1984; Sethi, 1996).

Estimation of Microbial Load

The microbial load viz. total bacterial count (TBC), total fungal count (TFC), and specific bacteria species viz. Enterobacteriaceae, *Escherichia coli, Salmonellaspp* and *Staphylococcus aureus* were estimated as per standard method (WHO, 1998).

Estimation of Heavy Metals

The analysis of heavy metals like lead, cadmium, mercury and arsenic was done as per standard methods (WHO, 1998 and AOAC, 2005).

Details of the Instrument and Operating Parameters

Atomic Absorption Spectrometer (AAS) was used to analyse heavy metals in drug sample from Thermo FisherM Series of 650902 V1.27 model.Hallow cathode lamp was used as light source to provide specific wavelength for Pb, Cd, Hg and As analysis. The operating parameters are summarized in the table given below:

	Instrument technique	**Wave length (nm)**	**Slit width (mm)**	**Lamp current (mA)**	**Carrier Gas**	**Flow rate of carrier gas (L/ min)**	**Sample flow rate (ml/ min)**
Lead (Pb)	Flame technique	217	0. 5	4.0	air and acetylene	1.1	2
Cadmium (Cd)	Flame technique	228.8	0. 5	3.0	air and acetylene	1.1	2
Mercury (Hg)	Cold vapour technique	253.7	0. 5	3.0	argon	1.1	5
Arsenic (As)	Flame vapour technique	193.7	0. 5	6.0	acetylene argon	1.1	5

Analysis of Aflatoxins

The Aflatoxinssuch as B_1, B_2, G_1 and G_2 were analyzed as per Official Analytical Methods of the American Spice Trade Association (ASTA, 1997).

Details of Instrument and Operating Parameters

High Performance Liquid Chromatography (Thermo Fisher) was used for the analysis of aflatoxinshaving Ultra C18column of length 250 x 4.6 mm of 5 µm particles with mobile phase of water: acetonitrile: methanol (65: 22.5: 22.5); flow rate was kept to 1 ml/min at 35ºC. Fluorescence detector was used at 360 nm; while the injected volume was 20 µl for the test drugs.

Analysis of Pesticide Residue

Pesticide residues were analyzed as per the standard method(AOAC, 2005) by Gas Chromatography-Mass Spectra (GC-MS) (Instrument-Agilent, detector-mass selective detector, column specification-DB5MS) in which carrier gas was helium at 1ml/min of flow rate in the column of 30 mlength, internal diameter was 0.25 mm while column thickness was 0.25 µm.

Results and Discussion

The prepared drug was obtained in brownish colour, semi-solid shows characteristics of its own odour and sweetish taste.

Identification

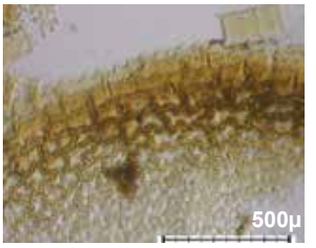
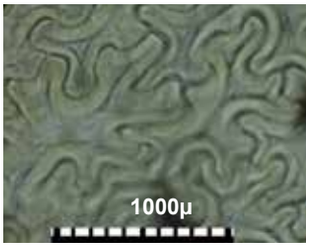
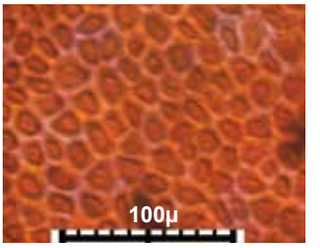
Microscopy

Small thick walled parenchyma cells (non-lignified) filled with brown contents from the epidermis of the fruit, larger parenchyma cells with heavily thickened (sclereids) wavy walls from the seed (Kaknaj); vessels with pitted thickening of length upto 200µ and breadth upto 50µ with oblique end walls and simple perforation plate; cork cells in surface view (Asaroon); pigmented layer in surface view, unicellular covering trichomes upto 300µ (Tukhm-e-Gajar); groups of thin walled cells arranged parallel to one another in 4 to 5 (parquetry arrangement) (Tukhm-e-Karafs); numerous conical unicellular thick walled warty trichomes of length upto 200µ (Anisoon);palisade like elongated parenchyma and polygonal parenchyma cells from the cotyledons filled with aleurone grains and oil (Maghz-e-Tukhm-e-Kharbuza / Maghz-e-Tukhm-e-Qurtum / Maghz-e-Tukhm-e-Tarbuz / Maghz-e-Tukhm-e-Kaddu / Maghz-e-Tukhm-e-KhiyarDaraz); vittae entire or broken pieces upto 250µ width and tapers towards the end (Anisoon / Tukhm–e-Gajar / Tukhm-e-Karafs); endosperm cells in surface view with moderately thick walledparenchyma cells contains fixed oil, aleurone grains and micro rosette crystals (Anisoon / Tukhm–e-Gajar / Tukhm-e-Karafs / Kaknaj).

Majoon-e-Hajr-ul-Yahood

(Fig.1)

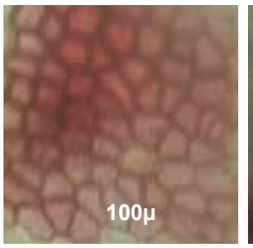
Kaknaj

Parenchyma cells with heavily thickened (Sclereids) wavy walls from the seed	Thick walled cells (enlarged)	Thick walled parenchyma cells from the epidermis of the fruit
		

Asaroon

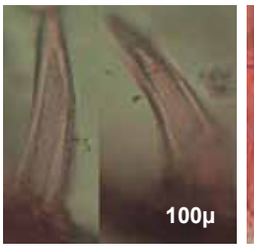
Pitted vessels

Cork cells

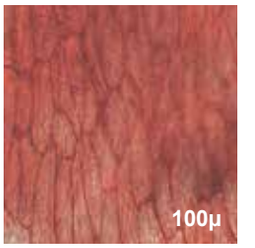


Tukhm-e-Gajar

Trichomes



Pigmented cells

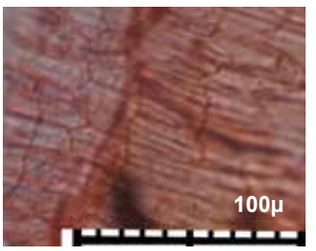


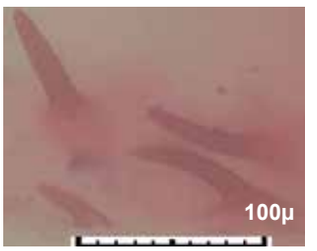
Tukhm-e-Karafs

Group of thin walled cells arranged parallel to one another (paraquetry arrangement)

Anisoon

Epidermal cells with unicellular trichome





Maghz-e-Tukhm-e-Kharbuza / Maghz-e-Tukm-e-Tarbuz / Maghz-e-Tukhm-e-Kaddu / Maghz-e-Tukhm-e-Qurtum/Maghz-e-Tukhm-e-KhiyarDaraz

Palisade like elongated cotyledonary parenchyma cells

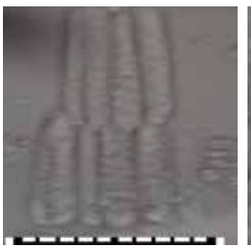
Polygonal cotyledonary parenchyma cells

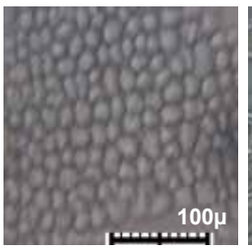
Endosperm cells

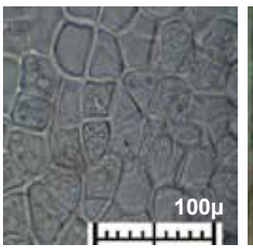
Anisoon/Tukhm-e-Karafs/Tukhm-e-Gajar / Kaknaj

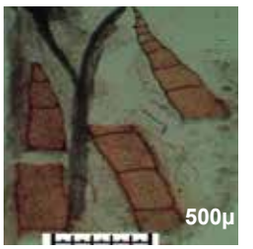
Vittae

(Multi cellular Trichomes)









Physicochemical parameters analysis:

Physicochemical parameters ofMajoon-e-Hajar-ul-Yahoodare tabulated in Table 2. Quantitatively evaluated data revealed that the moisture content was 18.67 %, ash content was 9.67 % and acid insoluble ash 1.21 % indicated the negligible amount of siliceous matter present in the drug. The water soluble extractive value of the drug 70.49 % indicated the presence of inorganic and more polar organic content and the alcohol soluble extractive value 29.33 % indicated the extraction of polar constituents.

Table 2: Physico-chemical parameters

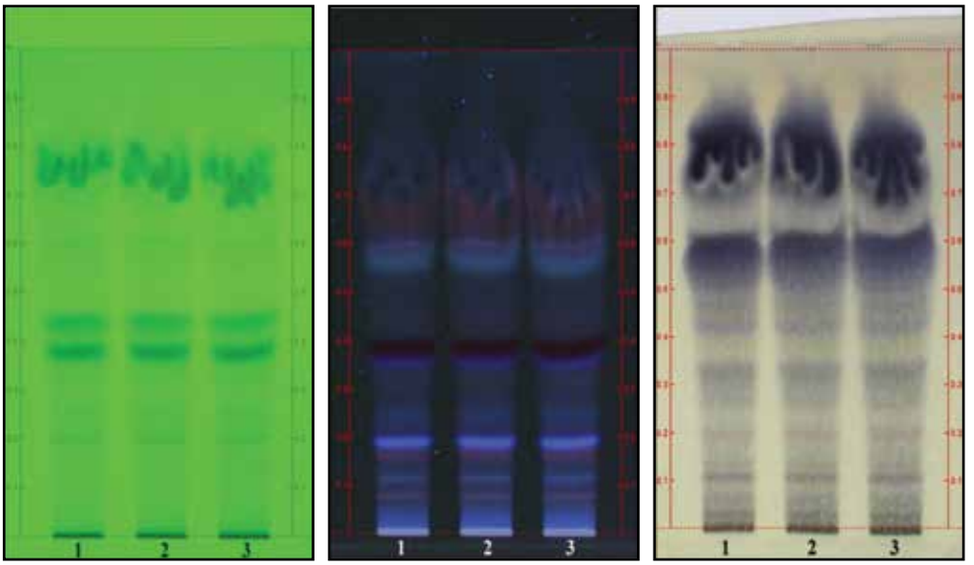
S. No	Parameters	Majoon-e-Hajar-ul-Yahood		
		Batch - I	Batch - II	Batch - III
1	Moisture (% w/w)	18.75	18.45	18.83
2	Extractive values (% w/w)			
	Alcohol soluble matter	29.24	29. 03	29.72
	Water soluble matter	70.24	70.84	70.40
3	Ash values (% w/w)			
	Total ash	9.64	9.44	9.94
	Acid insoluble ash	1.04	1.24	1.37
4	*pH* values			
	1% Aqueous solution	5.45	5.29	5.69
	10% Aqueous solution	4.37	4.41	4.47
5	Sugar estimation			
	Reducing sugar (% w/w)	20.08	20.22	20.46
	Non reducing sugar (% w/w)	32.84	32.34	32.49
6	Bulk density	1.6097	1.6207	1.6154
All values are mean of three determinations				

TLC Studies of Chloroform Extract

The TLC studies of chloroform extract are tabulated in Table 3. All the three batch samples showed identical spots in UV-254 nm, UV-366 nm and visible light (after derivatized with vanillin – sulphuric acid reagent). In UV – 254 nm, 366 nm and visible light it shows 06, 09 and 09 spots respectively with different Rf values (Fig. 2).

Table 3: R_f values of the chloroform extract of Majoon-e-Hajar-ul-Yahood

Solvent System	Rf Values		
	UV- 254 nm	UV – 366 nm	Visible light (after derivatization with vanillin – sulphuric acid reagent)
Toluene: Ethyl acetate: Formic acid (8:2:0.2)	0.76 Green	0.67pink	0.88 Violet
	0.60 Green	0.60violet	0.58 Violet
	0.44 Green	0.56florescent blue	0.46 violet
	0.38 Green	0.39 dark violet	0.42 violet
	0.26 Green	0.35 fluorescent blue	0.33violet
	0.20 Green	0.24 Blue	0.26greyt
		0.19fluorscent blue	0.20brown
		0.17brown	0.14 brown
		0.12 Blue	0.11violet



UV- 254 nm UV- 366 nm Visible Light(V.S.Reagent)

Fig.2: (TLC photos of chloroform extract)

HPTLC Finger Print Studies of Chloroform Extract

The finger print of the chloroform extract shows 12 peaks of which peaks at Rf 0.22, 0.43, 0.50, 0.81 and 0.84 were the major peak whereas peaks at Rf 0.03, 0.05, 0.12, 0.17, 0.29, 0.64 and 0.67 were moderately smaller peaks (Fig. 3). The HPTLC densitometry chromatogram of chloroform extract of three batch samples of Majoon-e-Hajar-ul-Yahood formulation were found to be same when scanned at 254 nm (Fig. 4)

TLC plate was developed using Toluene: Ethyl acetate: Formic acid (8:2: 0.2)as mobile phase. After development of spots plates were allowed to dry in air, finger print was recordedand densitometric chromatogram of the three batch samples of the compound formulation at 254 nm was obtained.

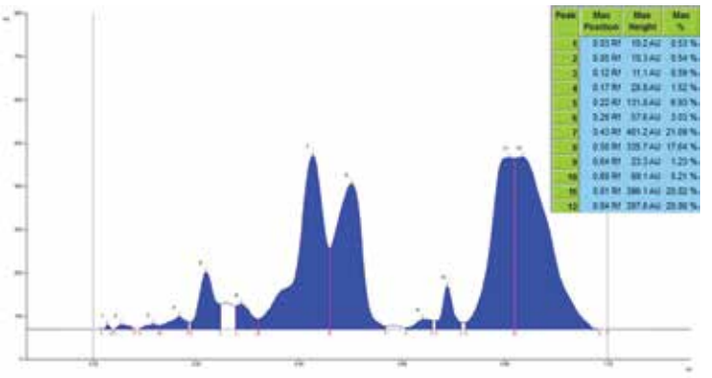


Fig.3: HPTLC finger print profile of chloroform extract of Majoon-e-Hajr-ul-Yahoodat 254 nm

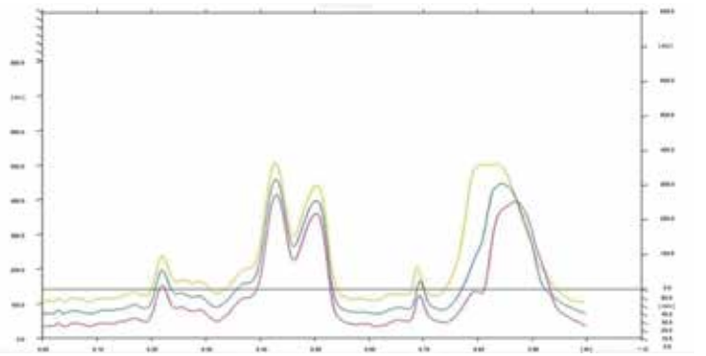


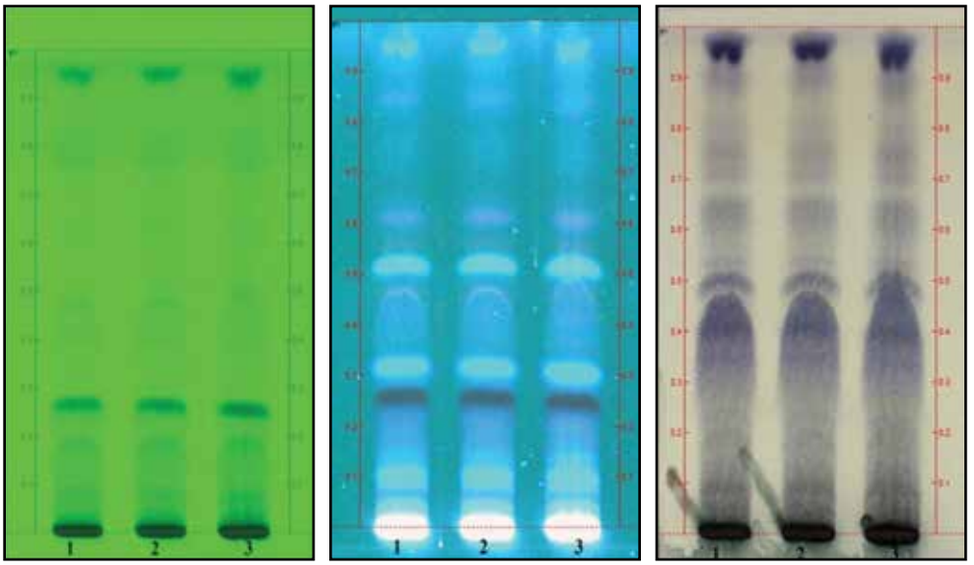
Fig.4: Densitometric chromatogram of chloroform extracts of Majoon-e-Hajr-ul-Yahoodat 254 nm

TLC Studies of Alcohol Extract

The TLC studies of alcohol extract are tabulated in Table 4. All the three batches of Majoon-e-Hajar-ul-Yahood formulation showed identical spot in UV-254 nm, UV-366 nm and visible light (after derivatized with vanillin – sulphuric acid reagent). In UV – 254 nm, 366 nm and visible light it shows 7, 9 and 8 spots respectively with different Rf values (Fig. 5).

Table 4: Rf values of the alcohol extract of Majoon-e-Hajar-ul-Yahood

Solvent System	Rf Values		
	UV- 254 nm	**UV – 366 nm**	**Visible Light(After derivatisation with vanillin – sulphuric acid reagent)**
Toluene: Ethyl acetate (1:1)	0.95 Green	0.94 Fluorescent blue	0.90 Grey
	0.79 Green	0.85Bblue	0.75 Violet
	0.63 Green	0.74 Blue	0.71 Gray
	0.48 Green	0.61Pink	0.64Gray
	0.41Green	0.52Fluorescentblue	0.54 Grey
	0.27Green	0.47 Pink	0.50 Violet
	0.18Green	0.32 Fluorescent blue	0.19 Gray
		0.26 Violet	0.10 Grey
		0.11 Blue	



UV-254nm UV-366nm Visible Light (V.S Regent)

Fig. 5: TLC photos of alcohol extract

HPTLC Finger Print Studies of Alcohol Extract of Majoon-e-Hajar-ul-Yahood

The finger print of the alcohol extract shows 10 peaks of which peaks at Rf0.21, 0.29, 0.57,0.90 and 0.95were the major peak whereas peaks at Rf0.09, 0.46, 0.55,0.73, and 0.83were moderately smaller peaks (Fig. 6). The HPTLC densitometry chromatogram of alcohol extract of three batch samples were found to be same when scanned at 254 nm (Fig. 7)

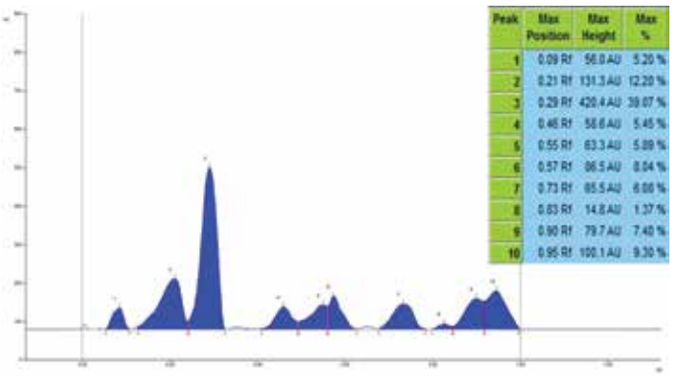


Fig. 6: HPTLC finger print of Majoon-e-Hajr-ul-Yahood alcohol extract at 254 nm

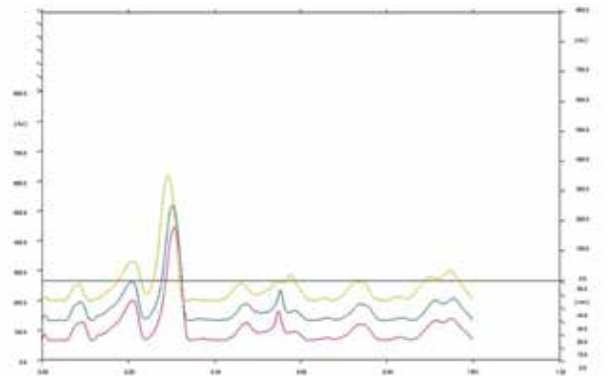


Fig.7: Densitometry chromatogram of alcohol extracts of Majoon-e-Hajar-ul-Yahoodlat 254 nm

Detection of WHO Parameters

The quality of drug samples was assessed by the estimation of microbial load viz. total bacterial count (TBC), total fungal count (TFC), Enterobacteriaceae, *Escherichia coli, Salmonellaspp* and *Staphylococcus aureus*. The total bacterial count andtotal fungal count were found to be in permissible limit and the other pathogens were not detected from the drug samples.The data are shown in (Table 5). While after analysis of heavy metals it was observed thatthe lead was present but within the permissible limit where as cadmium; mercury and arsenic were not detected from the drug samples (Table-6). The other parameters like estimation of afltoxins such as B_1, B_2, G_1 and G_2 and pesticide residuesviz.,organo-chlorine group, organo-phosphorus groups, alachlor, aldrin, chlordane, DDT, endosulfan, heptachlor, lindane and malathion were not detected in the drug.

Table 5: Microbial load data of Majoon-e-Hajar-ul-Yahood formulation

Parameters	Results	WHO Limits for internal use
Total Bacterial Count (TBC)	8x 10^2 cfu/gram	1x10^5cfu/g
Total Fungal Count (TFC)	1 x 10^2 cfu/g	1x10^3cfu/g
Enterobacteriaceae	Absent	1x10^3cfu/g
Escherichia coli	Absent	1x10^1cfu/g
Salmonellaspp	Absent	Absent
Staphylococcus aureus	Absent	Absent

Table 6: Analysis of heavy metals in Majoon-e-Hajar-ul-Yahood formulation

Sl. No	Parameters	Values	WHO Limits for internal us
1.	Lead	0.0101 ppm	10 ppm
2.	Cadmium	Not detected	0.3 ppm
3.	Arsenic	Not detected	3.0 ppm
4.	Mercury	Not detected	1.0 ppm

Conclusion

Evaluation of pharmacopoeial standards is very much important to justify the quality and to maintain the batch-to-batch consistency of Unani poly-herbal formulations. The evaluated pharmacognostical and physico-chemical parameters shall be helpful to fix the pharmacopoeial standards of the drug Majoon-e-Hajar-ul-Yahood. TLC/HPTLC finger print profile of chloroform and alcohol extracts provide a suitable method for monitoring the identity and purity and also in the standardization of the drug.The evaluated quality parameters viz. heavy metals, aflatoxins, pesticide residues and microbial load were found within permissible limit of WHO, which indicate that the drug is free from toxic materials and can be used to treat renal disorders.

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Medicinal Plants Used in the Folk Medicines of Kammarpally Forest Range of Nizamabad Forest Division, Telangana State

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Abstract

The present study highlights the collection of first-hand data from the traditional healers on folk-claims on medicinal plant wealth in Kammarpally forest range of Nizamabad district of newly formed Telangana State. The information are based on a systematic ethno-botanical survey to the area in December 2013. The study revealed fifty contemporary folk-medicinal claims comprised of thirty-five folk-medicinal plant taxa belong to twenty-nine families. These plants have been used extensively by the Naikpods, Lambadas and Yerukalas tribal communities of the area for the treatment of different ailments and conditions viz.; burning micturition, osteoarthritis, diabetes, stomachache, typhoid fever, bowels problems, headache, scabies, hysteria, tooth ache, edema, bone fractures, carbuncle, low libido, tonsillitis, abscess, cuts and wounds, cough, watering of eyes, insomnia, poisonous bites and others. The detailed description of the plants; botanical name, family, Unani name(s), collection number with locality, name of the tribe, part(s), name of the diseases against which the plants are used and dosage alongwith mode of administration for all the claims has been discussed in detail. The information provided on folk- claims on medicinal plants could be subjected to scientific testing to produce evidence based data that can lead to discover the new drugs of natural origin.

Key words: Medicinal plants, Folk medicines, Kammarpally forest range, Telangana state

Introduction

India is valuably rich in plant biodiversity and a vast reservoir of medicinal plants. Owing to the complex topography, climatic and physiographic conditions, the medicinal plant wealth varies greatly with the change in agro-climatic zones of the country. India is also an inhabitancy for oldest, richest and most diverse cultured traditions associated with the use of medicinal plants in the form of traditional systems of medicine. The plant based systems of medicine continue to provide the primary health care since thousands of years. The traditional communities live close to the nature has acquired the indigenous knowledge of using the plants against various disease conditions.

The indigenous system of folk medicines based on the use of plants by the local communities has been practiced for centuries and accumulated through generations from older to younger ones (Husain *et al.*, 2015b). This folk system still prevails in the rural communities. In recent years there has been resurgence of activities in ethno-botanical studies as it provides the way in modern medicine to discover new drugs of plant origin (Rajashekharan, 2002).

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Proper documentation on first–hand information from the traditional practitioner is need of the hour as the traditional knowledge is gradually decreasing day by day due to rapid urbanization and dependence of major population on modern health care systems. Based on this rationale the present study on folk-medicinal claims was undertaken in tribal pockets of Kammarpally range of Nizamabad forests and information recorded are presented.

The Study Area

The area of study was Kammarpally forest range, which lies in the Nizamabad forest division between latitudes 18°41'40.1" N and 19°00'55" and longitudes N 78°26'54.3"E and 78° 40' 17"E. Nizamabad forest division lies in the north-western part of Nizamabad district of Telangana between latitudes 18°10' 10'' and 19° 00' 55'' N and longitudes 77° 31' 17'' and 78° 40' 17'' E. Geographical area of the division is 5,219 Km2 which is 65.59 % of the area of district.

This region lies on deccan plateau. Godavari river enters Andhra Pradesh at Kandhakurthi in Nizamabad division. Manjira River, which flows in north-west direction through thick forests of Nizamabad and Kamareddy. The climate of this division is generally dry with temperatures ranging from 13°C to 47°C and the annual rainfall is about 1033.7mm, received mainly from south-west monsoons. As per Champion and Seth's (Champion and Seth, 1968) classification the forests of division fall under Tropical dry deciduous type.

The areas explored during the study were Bheem Nagar, Pandi Gutta, Bhodan Shiva, Manala, Bheemgal and Kammarpally (Fig.1). Various tribal groups like Naikpods, Lambadas and Yerukalas and others inhabit in all these areas. These tribal people are living in dense forest zones and have their own religious and social traditions.

Methodology

Extensive field work was conducted in December 2013. The information was collected through questionnaires, interview and discussions in the local Telugu language with the reliable informants such as tribal traditional healer and villagers. The questionnaire allowed responses on the plant, medicinal uses of its part, method of preparation (*i.e.*, decoction, paste, powder and juice), dosage, mode of the administration, form of usage (either fresh or dried) and whether the plants used either singly or in combination of other plants.

All the plants were taxonomically identified by the senior author with the help of related flora The Flora of Presidency of Madras by Gamble (1936) and other available works. Voucher herbarium specimens were prepared and deposited in the Herbarium of Survey of Medicinal Plant Unit of Central Research Institute of Unani Medicine (CRIUM), Hyderabad, for future reference and study.

Enumeration of Folk Medicinal Species

The medicinal plants taxa used as a folk-medicine are arranged in alphabetical order. Their botanical name, family, voucher specimen number, Unani name (wherever available), local name, habit, name of the disease(s), method of preparation, administration and name(s) of informants and their community are given in Table 1.

Table 1: List of Folk-Medicinal Claims Collected From Kammarpally Forest Range

Botanical Name/ Family/ Habit/ Field Book No.	Unani Name	Local Name	Area of Collection/ Tribal cast/ Tribe name	Used Plant Parts	Medicinal Uses
Acacia caesia (L.) Willd. (Mimosaceae), (Straggling shrubs), SMPU/CRI-Hyd: 11640	---	Korintha	Pandi Gutta/ Naikpod / Yadagiri	Leaves	1 External application of leaf juice on fore head relieves severe head ache.
Acalypha indica L. (Euphorbiaceae), (Herb), SMPU/CRI-Hyd: 11678	---	Muripinda	Bodhanshiva/ Naikpod / saianna	Leaves	1 Oral administration of leaf juice, about 3-6 ml. gives immediate relief from severe stomachache.
Agave americana L. (Agavaceae), (Shrub), SMPU/CRI-Hyd: 11701	---	Rakshasimatta	Manala/ Yerukalas / Madhava gangaram	Leaves	1 Leaves are grinded into paste, administered orally, about 5-8 gms, for every 3 hours after the bite of Viper and at the same time warmed leaf slices are kept on the site of bite and bandaged with cotton cloth. This treatment is claimed as best antidote for Viper's bite.
Aloe vera L. (Liliaceae), (Herb), SMPU/CRI-Hyd: 11683	Aelwa	Chinnakalabanda	Bodhanshiva/ Naikpod / *saianna*	Leaves	1 Consuming of leaf paste relieves burning micturition.
Argemone mexicana L. (Papaveraceae), (Herb), SMPU/CRI-Hyd: 11724	Satyanasi	Brahmadandi	Kammarpalli/ Lambada / Venkatesh	Root	1 External application of root paste on stomach for pregnant lady during 9th month causes early and easy delivery. 2 Consuming root about 5-7 gms works as sedative.

Botanical Name/ Family/ Habit/ Field Book No.	Unani Name	Local Name	Area of Collection/ Tribal cast/ Tribe name	Used Plant Parts	Medicinal Uses
Boswellia serrata Roxb. (Burseraceae), (Tree), SMPU/CRI-Hyd: 11674	Kundur	Anduga	Bodhanshiva/ Naikpod / *saianna*	Bark	1 Consuming of bark powder, about 8-10 gms daily with black goat milk relieves severe pain due to fracture of ribs and also claimed to fix the broken bones.
Butea monosperma (Lam.) Taub. (Fabaceae), (Tree), SMPU/CRI-Hyd: 11708	Dhak (Tesu)	Moduga	Manala/ Yerukalas / Madhava gangaram	Bark and gum	1 After the snake bite, if the snake is not recognized by the patient, 10 gms of the powder, prepared by pounding of the barks of following plants in equal quantities like *B. monosperma, Cochlospermum religiosum, Azadirachta indica, Dalbergia paniculata,, Diospyros chloroxylon, Diospyros malabarica, Pongamia pinnata* and *Vitex negundo* administered orally for every 2 hours works as a best antidote. 2 Oral administration of bark powder, about 5-8 gms, daily for a month relieves white discharge in ladies. 3 External application of gum in semisolid form relieves scabies and eczema.

Botanical Name/ Family/ Habit/ Field Book No.	Unani Name	Local Name	Area of Collection/ Tribal cast/ Tribe name	Used Plant Parts	Medicinal Uses
Calotropis gigantea (L,) R.Br., (Asclepiadaceae), (Shrub), SMPU/ CRI-Hyd: 11731	Madar/ Aak	Jilledu-chettu	Kammarpalli/ Lambada / Venkatesh	Latex	1 External application of latex on affected area relieves rheumatic pains. 2 The same also relieves tonsilitis. 3 Intake of latex works as an antidote for scorpion sting.
Cassia auriculata L. (Caesalpiniaceae), (Shrub), SMPU/ CRI-Hyd: 11726	Tarwar	Tanghedu	Kammarpalli/ Lambada / Venkatesh	Leaves	1 Leaves are claimed as laxative.
Cassia fistula L. (Caesalpiniaceae), SMPU/CRI-Hyd 11604	Amaltas	Rela	Bheem Nagar/ Lambadi / Mathya nayak	Bark	1 Consuming of bark powder, about 5-10 gms, daily 2 times for a week relieves typhoid fever. 2 Bark powder is claimed as laxative.
Crotalaria verrucosa L. (Fabaceae) (Shrubs), SMPU/CRI-Hyd 11601	---	Tella Eswari	Bheem Nagar/ Lambadi / Mathya nayak	Root	1 Oral administration of root powder, about 5-8 gms, works as a best antidote for scorpion sting. 2 The same also claimed as best antidote for cobra bite. 3 Cultivation of this plant as a house fencing repels the snake entry into the house.

Botanical Name/ Family/ Habit/ Field Book No.	Unani Name	Local Name	Area of Collection/ Tribal cast/ Tribe name	Used Plant Parts	Medicinal Uses
Datura metel L. (Solanaceae) (Shrubs), SMPU/CRI-Hyd: 11602	Dhatura Siyah	Nala Ummattha	Bheem Nagar/ Lambadi / Mathya nayak	Leaves and Seeds	1 External application of leaf juice along with little amount of camphor relieves rheumatic pains. 2 Seeds are used as rat poison.
Desmodium pulchellum (L.) Benth. (Fabaceae) (Shrubs),SMPU/CRI-Hyd: 11606	----	Deyyapu mokka	Bheem Nagar/ Lambadi / Mathya nayak	Fruits	1 Fruits are shade dried and pounded. Oral administration of this powder, about 6-8 gms relieves hysteria.
Dioscorea pentaphylla Linn. (Dioscoreaceae), (Climber) SMPU/ CRI-Hyd: 11610	---	Esurugaddalu	Bheem Nagar/ Lambadi / Mathya nayak	Root	1 During starvation condition, tribal people consume the tuberous roots as a protienacious food.
Diospyros melanoxylon Roxb. (Ebenaceae), (Tree), SMPU/CRI-Hyd: 11679	---	Beedi Aaku	Bodhanshiva/ Naikpod / saianna	Leaves	1 Warmed leaves are usually wrapped around the neck with a smooth cotton cloth. This treatment is given for one month daily relieves transilitis.
Dolichandrone spathacea (L.F.) K.Schum. (Bignoniaceae), (Tree), SMPU/CRI-Hyd: 11743	—	**Neeroddi**	Kammarpalli/ Lambada / Venkatesh	Leaves	Oral administration of leaf juice, about 10-12 ml., gives immediate relief from stomachache.

Botanical Name/ Family/ Habit/ Field Book No.	Unani Name	Local Name	Area of Collection/ Tribal cast/ Tribe name	Used Plant Parts	Medicinal Uses
Ficus microcarpa L.f. (Moraceae), (Tree), SMPU/CRI-Hyd: 11608	---	Yerrajuvvi	Bheem Nagar/ Lambadi / Mathya nayak	Bark	1 Oral administration of bark powder, about 8 gms daily for a month relieves Edema. 2 The same preparation for week relieves typhoid fever 3 Oral administration of bark powder, about 10 gms daily with goat milk relieves severe pain due to fracture of ribs and also claimed to fixed the broken bones.
Grewia hirsuta Vahl (Tiliaceae), (Shrub), SMPU/CRI-Hyd: 11635	---	Bidarachipuru	Pandi Gutta/ Naikpod / Yadagiri	Leaves and Stem	1 Oral administration of infusion prepared by leaves and stem relieves burning micturition.
Gymnosporia spinosa Merill. & Rolfe. (Celastraceae) (Shrubs), SMPU/CRI-Hyd: 11607	---	Danthi	Bheem Nagar/ Lambadi / Mathya nayak	Leaves	1 Chewing of young leaves relieves tooth ache.
Helicteres isora L. (Sterculiaceae), (Small tree), SMPU/CRI-Hyd: 11747	Maror Phali	Gubadadda	Kammarpalli/ Lambada / Venkatesh	Fruits	1 Dried fruits are pounded and administered orally about 4-6 gms gives immediate relief from severe stomachache.
Hyptis suaveolens Poit. (Lamiaceae), (Under shrub), SMPU/CRI-Hyd: 11751	---	Seema thulasi	Manala/ Lambada / Venkatesh	Leaves	1 Inhaling of smoke prepared by leaves relieves severe headache.

Botanical Name/ Family/ Habit/ Field Book No.	Unani Name	Local Name	Area of Collection/ Tribal cast/ Tribe name	Used Plant Parts	Medicinal Uses
Leonotis nepetaefolia R.Br. (Lamiaceae), (Under Shrub), SMPU/ CRI-Hyd: 11625	---	Mulugolimidi	Bheem Nagar/ Lambadi / Mathya nayak	Leaves	1 Oral administration of leaf powder, about 3-5 gms relieves labour pains and causes easy delivery.
Mitragyna parvifolia Korth. (Rubiaceae), (Tree), SMPU/CRI-Hyd: 11721	---	Nerkadamba	Bheemgal / Lambada / Venkatesh	Bark	1 Oral administration of bark powder, about 5-8 gms relieves, for a month relives edema disease.
Olax scandens Roxb. (Olacaceae), (Climbing shrubs), SMPU/CRI-Hyd: 11705	---	Turaka tappeda teega	Manala/ Yerukalas / Madhava gangaram	Leaves	1 External application of leaf juice, about 2-4 drops, relieves watering of eyes.
Opuntia stricta (Haw.) Haw. (Cactaceae), (Shrub), SMPU/CRI-Hyd: 11702	---	Naagajemmudu	Manala/ Yerukalas / Madhava gangaram	Fruits	1 Fruits are gently warmed and consuming these fruits gives immediate relief from severe cough
Pterocarpus marsupium Roxb. (Fabaceae), (Tree), SMPU/CRI-Hyd: 11672	Bijasar/ Baj-e-Sar	Peddayegi	Bodhanshiva/ Naikpod / saianna	Bark	1 Consuming of bark infusion, about 10 ml daily once for a month relieves osteoarthritis.
Selaginella bryopteris (L.) Bak., (Selaginellaceae), (Herb), SMPU/ CRI-Hyd: 11719	---	Sanjeevani	Bheemgal/ Lambada / Venkatesh	Whole Plant	1 Oral administration of powder, about 5-8 gms, prepared by whole plant relieves burning micturition. 2 The same also claimed as aphrodisiac.

Botanical Name/ Family/ Habit/ Field Book No.	Unani Name	Local Name	Area of Collection/ Tribal cast/ Tribe name	Used Plant Parts	Medicinal Uses
Semecarpus anacardium L. F (Anacardiaceae), SMPU/CRI-Hyd: 11605	Bhilawan	Nellajedee	Bheem Nagar/ Lambadi / Mathya nayak	Gum	1 External application of a gel prepared by using the gum with addition of water relieves severe headache. 2 The same preparation is also claimed to relieve scabies.
Sida acuta Burm. F. (Malvaceae), (Herb), SMPU/CRI-Hyd: 11690	-----	Gayapaku	Bodhanshiva/ Naikpod / *saianna*	Leaves	1 External application of leaf juice on abscess causes immediate burst. 2 The same application also claimed to heal the cuts and wounds.
Solanum xanthocarpum Schrad & Wendl (Solanaceae), (Herb), SMPU/ CRI-Hyd: 11638	Katai-Khurd	Nelamulaka	Pandi Gutta/ Naikpod / Yadagiri	Fruits	1 Daily consuming of 2 to 4 fruits controls the diabetes. 2 The same also claimed as an anthelmintic.
Soymida febrifuga (Roxb.) A. Juss. (Meliaceae), (Tree), SMPU/CRI-Hyd: 11673	---	Somida Chettu	Bodhanshiva/ Naikpod / saianna	Bark	1 Daily consuming of infusion, about 10 ml., prepared by bark controls diabetes.
Syzygium cumini (L.) Skeels (Myrtaceae), (Tree), SMPU/CRI-Hyd: 11713	Jamun	All neredu	Manala/ Yerukalas / Madhava gangaram	Bark	1 Consuming of bark infusion, about 10 ml. daily once for a month relieves osteoarthritis.

Botanical Name/ Family/ Habit/ Field Book No.	Unani Name	Local Name	Area of Collection/ Tribal cast/ Tribe name	Used Plant Parts	Medicinal Uses
Terminalia arjuna (Roxb.) Wight & Arn. (Combretaceae), (Tree), SMPU/ CRI-Hyd: 11610	Arjun	Arjuna	Bheem Nagar/ Lambadi / Mathya nayak	Bark	1 External application of fine bark powder on affected area for 3 months completely heals the carbuncle.
Vanda roxburghii R.Br. (Orchidaceae), (Epiphytic herb), SMPU/CRI-Hyd: 11677	---	Vadanike	Bodhanshiva/ Naikpod / saianna	Whole Plant	1 External application of paste prepared by whole plant, relieves rheumatic pains.
Ventilago denticulata Willd. (Rhamnaceae), (Tree), SMPU/CRI-Hyd: 11613	---	Suratighekka	Bheem Nagar/ Lambadi / Mathya nayak	Bark	1 Consuming of bark about 3-5 gms daily relieves rheumatic pains. 2 The same preparation is also claimed as aphrodisiac and also increase the sperm count.

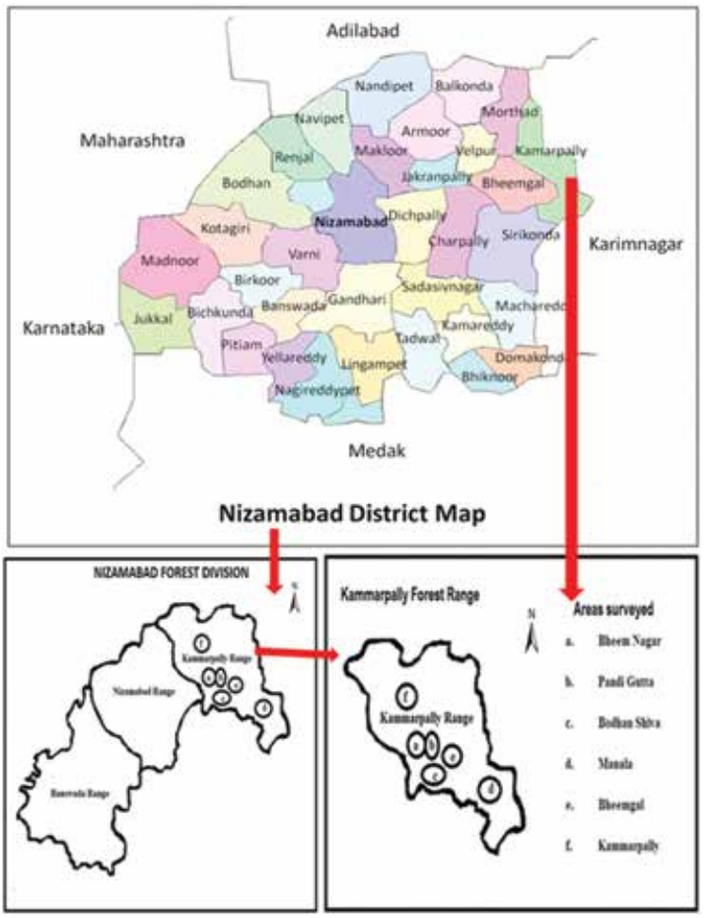

Fig 1: Map of the Study Area

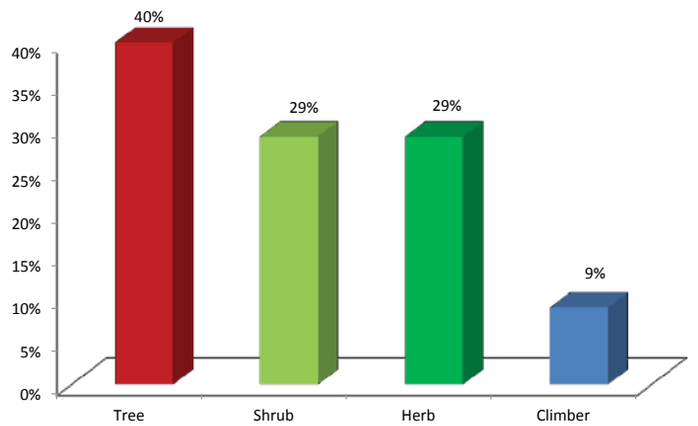

Fig. 2: Habit and Utilization (%) of Folk-Medicine

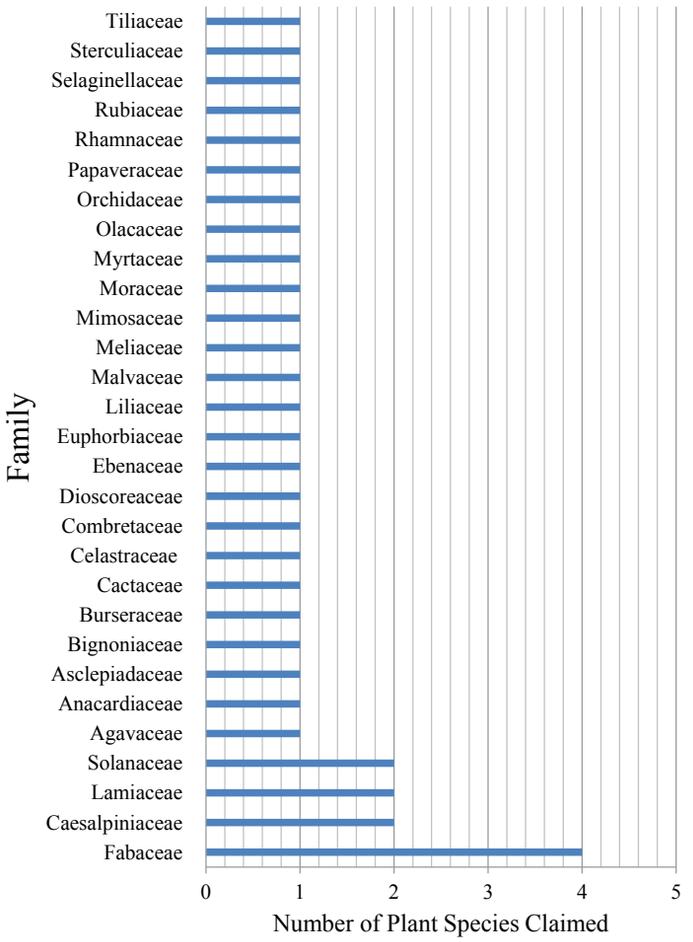

Fig. 3: Number of Plant Species and Families

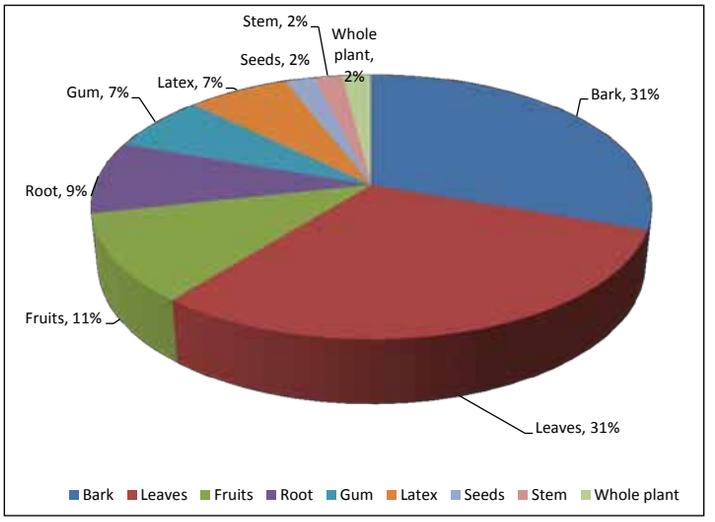

Fig. 4: Frequency (%) of Used Plant Parts

Results and Discussion

The present study has brought to light and discussed the age old practices of using the medicinal plants against the diseases by the tribal inhabitant of Kammarpally forest range. The tribal communities are the megastore of traditional knowledge (Husain *et al.*, 2015a). The knowledge of using the medicinal plants as medicine is primarily derived from two stream of knowledge, either through the codified stream or folk. The uniqueness of the Indian medical heritage lies in the fact that both ways of knowledge are living traditions. This legacy coexists since centuries and enjoyed a relationship between mankind and plants.

Nearly fifty (50) contemporary folk-medicinal claims comprising thirty-five (35) species belonging to thirty-four (34) genus and twenty-nine (29) families were recorded from the study area. The area showed a good extent of medicinal plants diversity. These medicinal plants are being used traditionally as folk-medicine by the Naikpods, Lambadas and Yerukalas tribes. Previous reports on the folk-medicinal claims of different districts of Telangana and adjoining areas provides substantial evidence of the presence and use of the medicinal plants by different tribal communities (Pradeep *et al.*, 2015; Vijigiri *et al.*, 2010, 2012). But no systematic survey has been undertaken specifically to Kammarpally range of Nizamabad, except few reports on the folk-medicinal plants used by the Naikpods tribes and others (Husain *et al.*, 2015a).

Of all these claims, nearly 72% are used internally and 28 % externally. Majority of external applications are against the rheumatic pains, severe headache, skin diseases, bone fracture, tonsillitis and as antidotes. While, for burning micturition, osteoarthritis, diabetes, stomachache, typhoid fever, bowels problems, hysteria, tooth ache, edema, low libido, cough, insomnia and poisonous bites the drugs claimed are to be taken internally. Not only this, the medicinal plants are also used as sedative, aphrodisiac, antidote for cobra-bite and laxative.

The most ascendant families of ethno-botanical importance were found to be Fabaceae with four (4) species, Caesalpiniaceae, Lamiaceae and Solanaceae with two (02) species and Agavaceae , Anacardiaceae, Asclepiadaceae, Bignoniacea,e Burseraceae, Cactaceae, Celastraceae, Combretaceae, Dioscoreaceae, Ebenaceae, Euphorbiaceae, Liliaceae, Malvaceae , Meliaceae, Mimosaceae , Moraceae , Myrtaceae, Olacaceae, Orchidaceae, Papaveraceae, Rhamnaceae, Rubiaceae , Selaginellaceae, Sterculiaceae and Tiliaceae with one (01) species only (Fig. 3).

The tribal inhabitants of the studied area largely used the folk-medicines from the trees (40%), followed by shrubs and herbs (29 %), and climbers (9%) (Fig. 2).The most frequently utilized plant parts (Fig. 4) were leaves and bark (31 %), followed by Fruits (11 %) then roots (9 %), gum and latex (7%), seeds, stem

and whole plant (2%). All these plant parts were claimed to be used in the form of decoctions, extracts, paste, juices and powders. Among the different plant parts used for the preparation of folk-medicine, the leaves and bark were the most important and frequently used parts. The oral administration of the leaves and bark prescribed in majority of the preparation reported in the present study.

Nevertheless, the data collected during the study has also been compared with some recent and past available literature (Anonymous, 1976, 1992; Balaji Rao *et al.*, 1995; Hussain *et al.*, 1992; Jain *et al.*, 1991; Chetty and Rao, 1989; Goli *et al.*, 2014; Hemadari, 1991; Hemadari *et al.*, 1987, 1988; Vijaykumar and Pullaiah, 1998; Nagaraju and Rao, 1990; Balaji Rao *et al.*, 1995; Pradeep *et al.*, 2015; Vijigiri *et al.*, 2010, 2012; Gupta *et al.*, 1997, 2007, 2008, 2010a, 2010b; Hussain *et al.*, 2015a, b; Vedavathy, 1998; Murthy, 2012; Lingaiah and Nagaraju, 2013). It has been found that most of the folk-medicinal claims are duly reported, however, their mode of application, ingredients and parts used are quite different from earlier published reports. Hence, the present study represents contemporary folk uses of medicinal plants of the area investigated. It would be worthwhile to subject all these folk-medicinal claims to scientific validation by the latest pharmacological and clinical studies. It is likely that through such investigations new drugs of plant origin may be discovered for the treatment of many of the ailments for which there is no satisfactory cure in modern allopathic system of medicine, thus far.

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Bukan Booti (*Lippia nodiflora* L.) - A Lesser Known Unani Drug

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Abstract

Lippia nodiflora Linn. is a small fast growing perennial creeping herb which belongs to the family Verbenaceae. The plant is found throughout India and known as *Bukan Booti* in Unani system of medicine and *Jalpapili* in Ayurveda. The whole plant is used for medicinal purpose. It has been a source of traditional medicine against diseases like liver disorders, dandruff, fever, inflammation, indigestion in children etc. In Unani Medicine the leaves, root and the whole plant are used to cure several diseases like cough, retention of urine, renal and vesicle calculus, cut and wounds, boils, epistaxis, bleeding piles, and palpitation due to excess of *safra* etc. It is also used in, asthma, bronchitis, gonorrhoea and joint pain. In this paper the plant has been reviewed for its uses in Unani Medicine and for its phytochemical and pharmacological studies and scientific validation.

Key words: Bukan Booti, Jalpapili, *Lippia nodiflora* L., Verbenaceae, Bleeding piles

Introduction

Lippia nodiflora L. is a medicinal herb belonging to the family, Verbenaceae. It is commonly known as Bukan Booti in Unani Medicine. The whole plant is used for the treatment of various diseases including piles, epistaxis, renal and vesical calculi, cough, asthma, bronchitis etc. In addition to the other therapeutic effects, this herb has been considered as *Ikseere* (having highly significant effect) in the treatment of bleeding piles. It is used orally in the dose of 10 gm. It has been observed that the drug is harmful in peoples having hot temperament however use of some corrective drug such as *Piper nigrum* L. or honey along with *Bukan Booti* reduces its adverse effect (Ashraf, 2011; Ghani N, 2011; Kabiruddin, YNM; Prasad, 1994).

Botanical Description: *Lippia nodiflora* L. belonging to the family Verbenaceae is a fast growing perennial prostrate creeping herb rooting at nodes. *Stems* prostrate, much branched, subquadrangulate, glabrous, green to purple in colour when young and can become somewhat grey and woody with age, branches slender about 20-90 cm long; procumbent densely appressed, pubescent.

Leaves simple, opposite, small, 1.8-3.7 cm long, spatulate, cuneate at base, apex rounded obtuse deeply and sharply serrate or bluntly toothed, above the midle, pubescent on both surfaces, *petiole* 2-7 mm long or absent extipulate, having a greyish green appearance due to a covering of fine hairs on their surface.

Inflorescence-axillary 1.0-2.5cm x 0.5-1.0 cm long after mature, densely many flowered, peduncle 1-11.5cm long, bracteolate.

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Flowers irregular, bisexual, very pale violet pink, sessile, densely packed, head at first nearly globose but becoming spicate and oblong in fruit, peduncles 2.7-7.5 cm long, from axill of one only of each pair of leaves, bract ovate, acute or subacute; *Sepals* 2, almost distinct; *Calyx* bilobed up to 2 mm long; *Corolla* white, purple to pink bilipped, upper lip erect and bifid, the lower lip three lobed, middle lobe larger; *Stamen* 4, dedynamous; *Anthers* dorsifixed dehising longitudinally; *Ovary* superior bicarpellary.

Fruits dry, minute about 1-1.5 mm in diameter release two tiny brown, oval, flattened seeds at maturity; *Style* very short (Mc Cosker, 1994; Jayweera, 1981).

Fig. 1: Bukan Booti *Lippia nodiflora* (L.) E. E. Greene

Vernacular Names

Arbic	:	Fifilul Ma
Bengali	:	Kaanchra Ghaas
Eng.	:	Frog fruit, Lippia, Wild sage
Gujrati	:	Rat Bolio; Ratolia, Vakkan
Hindi	:	Bukan, Bhuiokra, Jalpapili, Jal peepal, Jal peepli, Ludra
Kannad	:	Nilahipalli
Panjabi	:	Toot Booti
Philippines	:	Busbusi, Chachahan
Sanskrit	:	Agni Jvala, Bahushikha, Chitrapatri, Jalpippali, Jalkarna, shakuladani, vasir, vasuka
Sinh.	:	Hiramana-detta
Tamil	:	Poduthalai, Podutalei
Thailand	:	Yaa Riet Pla
Unani	:	Bukan Booti, Bukkum Booti

Urdu	:	Bogan Booti, Bukan Booti
Synonyms	:	*Lippia nodiflora* (L.) A. Rich, *Lippia reptans* Kunth, *Phyla incisa* Small, *Phyla nodiflora* L.
Classification		
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Order	:	Lamialas
Family	:	Verbenaceae
Genus	:	Phyla
Species	:	*nodiflora*

Distribution

It is a native of California and distributed in India, Sri Lanka, Baluchistan, South and Central America, Tropical Africa and Philippines Islands. It is commonly found in abundance in the warmer parts of India ascending up to 900 m on the hills and near wet places e.g. on the banks of rivers, irrigation canal edges and planes in different parts of India like, Andhra Pradesh, Karnataka, Kerala, and Maharashtra, some parts of Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal (Khare, 2007; Sharma, 2013). Photos of the plants under review were taken from Kolkata, West Bengal (Fig. 1).

Habitat

Lippia grows best on bared ground in periodically moist sites (heavy rainfall, flooding or opening of springs and river bank) that also undergo periods of water stress and with apparently poor soil structure (Chopra, 1969; Sharma, 2013).

Chemical constituents

Phyla nodiflora contains flavonoids, flavones aglycones, flavone sulphates, phenols, sugar, sterols, essential oil, resin, non glucosidal bitter substance, tannin and potassium nitrate etc (Anonymous, 1962). Some other constituents like nodifloretin (Basu, 1969), 6-hydroxyluteolin glycosides (Nair, 1973), hallerone and halleridone (Ravikanth, 2000] and monoterpenes (Terblanche, 1996)] are also reported. Recently, a new terpenoid known as lippiacian was isolated from this plant (Siddiqui, 2007)].

Description of the plant in Unani literature

In Unani literature it is commonly known as *Bukan Booti* but in some parts called as *Bukam Booti*. It has thin branches; leaves small, broad on the apex and narrow on base; flower small and rounded appears on axillary nodes (Ashraf, 2011; Ghani, 2011).

Temperament

According to Unani physicians it is of Hot and Dry in II degree. Vaidyas told that it has cold temperament (Ghani, 2011; Kabeeruddin, 2007).

Toxic, adverse effect: It is not suitable for the person having Hot temperament (Kabeeruddin YNM).

Correctives: *Piper nigrum* L. and honey are used along with Bukan Booti to remove its adverse effects (Kabeeruddin, YNM).

Action and Therapeutic

According to Unani physicians it removes morbid and toxic matters which are produced due to excess of yellow bile and phlegm. It has *mubarrid* (febrifuge), *musaffi khoon* (blood purifier), *mudir* (diuretic), *mufattit-e-hasat* (lithotryptic), *munaffis balgham* (expectorant), *dafe zeequnnafas* (antiasthamatic), *dafe jaraseem* (antimicrobial), *musakkin-e-alam* (analgesic) properties. On the basis of these properties it is commonly used in fever, epistaxis, boils, swellings, cough, haemorrhoids, palpitation, loss of consciousness, retention of urine and renal calculus (Ashraf, 2011; Ghani, 2011; Prajapati, 2003).

Fever

Root paste (20 gm) is given with water twice daily for 7 days to treat common fever and juice of the leaves is useful in cases of *Hummiyat-e-Ufuniya balghamiya* (fever due infection in phlegm) (Anonymous, 2001; Ghani, 2011).

Epistaxis

It stops bleeding from the nose in case of *ruaaf* (epistaxis) (Ghani, 2011).

Cough

It is useful for *sual* (cough) which occurs due to *burudat* (cold) (Ghani, 2011).

Boils, swellings, cut and wounds

For early maturation a poultice of the fresh leaves is applied on *busoor* (boils) and *nutool* (irrigation) with the decoction of leaves on *awram* (inflamations) gives beneficial effect (Ashraf, 2011; Ghani, 2011). Whole plant is made into paste and applied externally on cuts and wound Anonymous, 2001). According to Nadkarni a poultice of the plant is applied on swollen cervical glands, for erysipelas and chronic indolent ulcers (Nadkarni, 1954).

Bleeding piles

According to Ghani (2011) leaves juice prepared by a specific method is used to cure *bawaseer* (piles). Leaf paste (15 gm) is given twice a day, for two weeks to treat bleeding piles (Anonymous, 2001; Ghani, 2011).

Renal disorders

Being a *mudir* (diuretic) and *mufattit-e-hisat* (lithotryptic), an infusion of the leaves is used in *sozish-e-baul* (burning micturition), *usr-e-baul* (difficulty in micturition), *ehtebas-e-baul* (retention of urine), *suzak* (gonorrhoea) and *hasat-e-gurda wa masana* (renal and vesicle calculus) (Ghani, 2011; Ashraf , 2011).

Palpitation

It is useful in case of *Khafqaan Har* (palpitation which occurs due to heat) (Ghani, 2011).

Skin problems and hair affections

Bukan Booti is used in traditional medicines for the treatment of various skin affections and as a folk cosmetic among the tribal communities of North-West Frontier Province, Pakistan (Arshad, 2010). A pilot study was conducted on the simple Siddha remedy for hizhuvettu (alopecia areata) demonstrated promising results (Panniachary, 1989). It has been suggested that the plant extracts of any of the two plants viz. *Datura metel, Murraya koenigii, L. nodiflora*, and *Wrightia tinctoria* possess antidandruff application (Narayana *et al*., 2002).

Indigestion

The tender leaves and stalk of this plant are given in the form of an infusion to children suffering from indigestion.

Recent researches and other scientific reports

The diuretic (Sangita Shukla 2009), anti *H. pylori* (Yuan Chuen Wang, 2005), antihypertensive (Rekha Gadhvi *et al*., 2012), antinociceptive (Ahmed, 2004), antifungal (Pirzada, 2005) antimicrobial (Malathi,2011), and antibacterial (Salve and Bhuktar, 2012), activities of the plant have been evaluated in different experiments. The ethanolic extract and the chloroform extract of *L. nodiflora* produced central inhibitory (sedative), anticonvulsant and anxiolytic effects in mice but the petroleum ether extract of plant did not produce any central effect (Kumaresan, 2011). Acute toxicity studies revealed the non-toxic nature of the methanol extract of *L. nodiflora*. It exerts significant antidiabetic and hypolipidaemic effect in STZ-induced diabetic rats (Rangachari, 2011). The

methanol and ethyl acetate extract was investigated for anticancer effect and result showed that MCF7 cells were inhibited by all the extracts with IC50 ranging from 90-120 µg/ml (Peik Lin Teoh, 2013). The anti pyretic activity of plant extracts in rodents was found effective (Forestieri, 1996). The crude methanol extract and the isolated compound of cyclo-pentano phenanthrenol from *L. nodiflora* were evaluated for anti-inflammatory activity by Durairaj *et al*. (2007) and Ahmed *et al*. (2004). Themethanolic extract of *Lippia nodiflora* (L.) E. E. Greene has been evaluated for antitumor activity using Erich's ascites carcinoma (EAC) bearing Swiss albino mice (Durairaj, 2009).

The review indicated that although Bukan Booti is a lesses known plant but it is attributed to possess a number of pharmacological effects for which it is used by the physicians of Unani and other traditional medicine and by the folklore healers to manage different diseases. Scientific studies conducted on this plant not only validated some of the claims of Unani medicine but also explored many new therapeutic potential of this plant. Similarly a number of chemical constituents have also been isolated from it which may prove to be of medicinal importance. The findings suggest that Bukan Booti is a medicinal plant with very promising therapeutic potential, therefore, further experimental and clinical studies are warranted to explore its complete pharmacological and therapeutic profile.

Conclusion

The present review clearly demonstrated that Bukan Booti possesses antiinflamatory, diuretic, antibacterial activities. Most of the claims made in Unani literature about the efficacy and therapeutic uses of the drug have been validated through scientific studies.

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Ethnomedicinal Plants of Asteraceae Used by Bhotia Tribe of Spiti Valley, Himachal Pradesh

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Abstract

In order to explore plants used as ethnomedicine by *Bhotia* tribe, various field surveys were conducted in different parts of the Spiti valley during May, 2009 to September, 2016 at regular intervals to cover the study area of all successive floristic patterns ranging from 3000-4600 m altitude. Simultaneously available species of Asteraceae family of each altitudinal zone were collected and information on ethno-medicinal uses was collected through semi-structured interviews. The present study provides information on local uses of 40 species belonging to 24 genera. Most frequently used plant parts in medicine were whole plant (15 sps.) followed by leaves (14 sps.), aerial part (13 sps.), root (6 sps.), flower & inflorescence (3 sps. each), wool (1 sps.). These ethno medicinal plants are used to cure various ailments in different ailment categories viz., Gastro-intestinal diseases (gastric problem, stomachache, food poisoning , Vermifuge, indigestion, constipation, diarrhea, gastritis); dermatological conditions (cuts and wounds, burns, boils, skin eruption); fever (common fever); respiratory (pneumonia asthma chronic bronchitis throat infection cough and cold); liver complaints (jaundice, liver tonic); Circulatory system (blood pressure, blood blockage, blood circulation, blood purifier) dental care (toothache); ENT (stop nose bleeding, coryza); endocrine (diabetes); sleep disorder (insomnias). Further chemical and pharmacological studies on the reported medicinal plants are suggested for discovery of new therapeutic agents of natural origin.

Key words: Asteraceae, Ethnomedicine, Cold desert, Traditional knowledge, Spiti Valley, Himachal Pradesh.

Introduction

The family Asteraceae, formerly known as Compositae, largest and highly evolved family among angiosperm represented by 43 tribes, 1600-1700 genera and 24000 species distributed around the globe except Antarctica (Funk *et al*, 2009). It is not dominated by numbers but also by abundance, constituting 10% of total flowering plants (Funk, 2005). In India there are 45,000 total plant species, where 1052 species under 177 genera are of Asteraceae family (Rao *et al*. 1988). Several folk medicinal plants of Asteraceae family have shown pharmacological activity as they produce sesquiterpenes, lactones, pentacyclic triterpenes, alcohols, various alkaloids, flavonoids, diterpenoids acetylenes and tannins (Chethan, 2012; Suheda, 2015). Several studies demonstrated the antibacterial, antifungal, anti-inflammatory, insecticide, and antitumor capacities of Asteraceae species (Suheda, 2015). Being the largest family of vascular plants with diversity of habit, habitat and cosmopolitan distribution, Asteraceae family

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offers an ample scope for exploration and selection of ethno medicinal plants for further pharmacological research and drug development.

India is very rich in ethno cultural heritage where the art of herbal healing has very deep roots in tribal culture and folklore. There are 427 tribal communities in country and a considerable proportion of tribes living in remote areas with no access to modern medicine and healthcare services (Kala, 2005). Even today, most of the tribal communities are dependent upon local traditional healing systems for their primary health care. They have been using their traditional medicines based on plant resources around them for treating minor and major ailments. Spiti valley is one of the exceptional locations in the Indian Himalayan region which offers immense scope for ethnobotanical studies. It is situated between 31º 42'-33º N latitudes and 77º 37'- 78º 85' E longitudes in the high altitude cold arid zone of north-eastern part of the India state of Himachal Pradesh. Vegetation in Spiti valley is broad, completely rugged and characterized with dry alpine scrubs and alpine meadows which dominated by asteraceae family (Aswal and Mehrotra, 1994). Some outstanding high altitude herbs of Asteraceae common in alpine zone having highly attractive and showy flowers such as *Taraxacum* sp., *Saussurea* sp., *Chrysanthemum* sp., *Cicerbita* sp., *Senecio* sp., *Waldheimia* sp. which are widely used by local people in traditional medicine use. Because of unique geographical situations, valley harbors distinct ethnic and biological diversity. This is one of regions in the country, where traditional healing system is still popular among the local people. Spiti is inhabited by *Bhotia* (*Bodhs*) ethnic group. They possess a rich knowledge on utilization of the plant resources around them for food, fodder, medicine and other purposes. Being a remote area and less accessibility of modern health facilities they are largely depend on indigenous medicines system known as *Amchi System of Medicine*, which is an offshoot of Tibetan System of Medicine, where local practitioners who prescribe medicines are called *Amchis* (Brij Lal *et al*., 2001). Like Ayurveda, Unani, Siddha, Homoeopathy and folk medicine practiced, *Amchi System of Medicine* is also one among traditional systems of medicine in the country. Consequently, documentation of this valuable information lying with the inhabitant of Spiti valley has become vital to discover potential sources of herbal medicine as well as it also helps to preserve age-old traditional knowledge before it is lost forever. Though information on traditional medicinal use of plant resources of valley are available as reported by earlier workers (Lal and Singh, 2008; Sekar and Srivastava, 2003, 2005; Chauhan and Lakhanpal, 2000; Usha *et al*., 2014, 2015; Usha and Thakur, 2011; Jain, 1996; Kala, 2002a&b, 2006; Kala and Manjrekar, 2000; Seth and Usha, 2014; Sharma *et al*., 2006; Singh *et al*., 2012; Singh and Lal, 2008; Sood *et al*., 2001), but, the high dependency and strong belief of native people on herbal healers and their traditional herbal therapy provide enormous scope to explore the existing flora for traditionally used medicinal species which can also lead to new drug discovery.

Methodology

An extensive survey of Spiti valley was carried out during May, 2009 to September 2016 at regular intervals to cover the study of all successive floristic patterns ranging from 3000-4700 m altitude. Simultaneously available herbs of Asteraceae of each altitudinal zone were collected, dried, documented and were identified with the help of relevant floras (Aswal and Mehrotra, 1994; Sekar and Srivastava, 2009; Chowdhery and Wadhwa, 1984; Dhaliwal and Sharma, 1999; Hooker 1872-1897; Polunin and Stainton, 1984; Singh and Rawat, 2000; Stainton, 1988). Standard procedures were adopted for collection, preserving and identifying the specimens (Jain and Rao, 1977). The voucher specimens were matched and compared with the authentic specimens lying with the herbarium of Botanical Survey of India (BSI), Dehradun (BSD) and deposited in the Laboratory herbarium of HPU, Shimla, as reference material. Information of folk medicinal claims of plant species were collected from local knowledgeable people, elderly people, village headmen, women, and *Amchi* (traditional doctors) through questionnaires and was cross checked with other informants following standard ethnomedicinal methods (Jain, 1995). Details for local names of the plants, parts used, ailments treated, mode of administration, and curative properties were recorded. Status of occurrence of plants was recorded through visual observations and information provided by local inhabitants. The species which found frequently are considered common (C); species found after wider distance in small patches were considered scattered (S); and thinly distributed species found in a few places were noted rare (R). Altitude of the area was noted down with the help of GPS (Make; Garmin GPSmap76CSx).

Table 1: Ethno-medicinal plants of Asteraceae family of Spiti valley

S. No.	Taxa	Local name	Locality	Altitude range	Occ.	Life Form	Part Used	Traditional uses
1	*Achillea millefolium* L.	Seijum	Sagnam, Gue	3880-3900 m	S	H	Lf, Fl	Leaves and flower dried in shade and grinded into powder. One teaspoon powder used for gastric problem. Young leaves chewed for toothache. Paste of fresh leaves used on cuts and wounds.
2	*Anaphalis nepalensis* (Spreng) Hand-Mazz.	Monpig	Hansa, Kunzum slope	3800-4400 m	S	H	Lf, Wp	Whole plant is boiled in water and decoction prepared is used for the treatment of cold and fever. Paste of leaves is applied on cuts and wounds for healing.
3	*Anaphalis royleana* DC.	Kirchee Mentok	Kunzum slope	3100-4500 m	S	H	Lf	Paste of leaves is used for body pain and decoction of leaves used for fever and stomachache.
4	*Anaphalis triplinerus* (Spreng.) Hand. Mazz.	Tayung, Morping	Kunzum slope	4200-4650 m	S	H	Lf, Ap	Fresh leaves paste applied on cuts, wounds and skin problem. Powder of aerial part is used for food poisoning.
5	*Arctium lappa* L.	Jisung	Lari	3200 m	S	H	Wp	Paste of whole plant is applied on burns and joint pain.
6	*Artemisia biennia* Willd.	Sar-Bung-Karpo	Tabo, Poh	3000 -3200 m	S	H	Wp	Paste of whole plant is used on cuts and wounds. Powder of whole plant is used for cough and cold.
7	*Artemisia capillaris* Thunb.	Khamtso	Kungri, Gulling, Kurith	3200-3750 m	S	H	Inf, Lf	Decoction of inflorescence used to cure pneumonia and jaundice. Leaves powder mixed with cow ghee and massage for joint pain.

S. No.	Taxa	Local name	Locality	Altitude range	Occ.	Life Form	Part Used	Traditional uses
8	*Artemisia dracunculus* L.	Bhurna	Kyurik, Tabo, Chidang Lari	3500-3900 m	S	H	Wp, Lf	Extraction of whole plant is used for intestinal worms, toothache and as febrifuge. In veterinary leaves paste applied on wounds for healing.
9	*Artemisia gmelinii* Web.ex. Stechm.	Nurcha	Gue, Dhankar	3350-3900 m	S	H	Lf, Ap	About 5-10 mg powder of leaves taken with water to expel intestinal worm. Paste of leaves used on wounds and boils. Decoction of aerial part is used for the treatment of cough and fever.
10	*Artemisia japonica* Thunb.	Nireha	Lossar	3200-3850 m	S	H	Lf	Fresh leaves boiled in water on low flame. After cooling decoction is taken as vermifuge.
11	*Artemisia maritima* L.	Atonge-carpo, Burse	Hansa, Lingti, Kewling, Kyoto, Lidang	3100-4200 m	C	Sh	Wp, Lf	Paste of whole plant is used on cuts, wounds and skin problem. Decoction of leaves is used to cure joint pain, cough, stomachache, indigestion and fever. In veterinary plant is used for stomach complaint.
12	*Artemisia moorcroftiana* Wall. ex DC.	Khambasa	Rangrik, Kunzum pass	3700-3950 m	S	H	Wp	Paste of whole plant is used on cuts and wounds for healing.
13	*Aster flaccidus* Bunge	Phalukaro, Seertik	Kunzum slope, Gulling	4000-4790 m	S	H	Lf, Wp	Paste of leaves is applied on cuts and wounds. About 5-6 g powder of dried whole plant taken for cough, cold and fever,
14	*Breea arvensis* (L.)Less	Racho	Kaza, Kibber, Silling, Gulling	3200-4200 m	S	H	Lf	Paste of leaves is applied on skin eruption.
15	*Centaurea depressa* M. Bieb	Pashakha	Shego, Mane	3400-3600 m	S	H	Ap	Aerial part boiled in one glass of water for 10-15 minute and after cooling decoction is used for diabetes, cough, abdominal pain, blood purification and to control blood pressure.

S. No.	Taxa	Local name	Locality	Altitude range	Occ.	Life Form	Part Used	Traditional uses
16	*Chrysanthemum pyrethoides* (Kir. & Kir.) B. Fedtsch.	Burse	Kunzum pass, Takcha	4200-4500 m	S	H	Wp	Paste of whole plant as poultice is used for joint pain and skin problem. Smoke of whole plant is inhaled to get relief from asthma.
17	*Cousinia thomsonii* C.B.Clarke	Tawa	Dhanka, Rangrik, Mikkim, Lhalung, Komic	3300-4680 m	C	H	Rt, wool	About ½ teaspoon of dried root powder is taken to cure joint pain twice in a day. Cotton wool of plant is used as acupressure to get relief from body pain, muscular pains, to stop nose bleeding and blood blockage due to hurt.
18	*Crepis sancta* L.	Nusho-serpo	Pin valley	3750-3900 m	C	H	Ap	About 10-15 gm powder of aerial plant is taken for stomachache and constipation.
19	*Erigeron acer* L.	-	Kyoto, Hansa	3500-3700 m	C	H	Rt	Root paste is use for skin eruption.
20	*Erigeron alpinus* L.	Achak	Mud, Komic	3300-4500 m	C	H	Wp, Ap	Extraction of whole plant is applied on cuts and wounds. Decoction of whole plant is used for fever, cold and cough. Powdered of aerial plant part is given to cure joint pain.
21	*Erigeron multiradiatus* (DC).Benth.ex Clarke	Lukmik	Gue , Gette	3900-4500 m	C	H	Lf	Leaves powder is used to cure stomach problem.
22	*Inula racemosa* Hook.f.	Poshakar	Mane	3600 m	-	H	Rt	Root paste is applied for skin eruption and boils. Roots decoction is used to cure asthma, cold, cough and chronic bronchitis.
23	*Jurinea ceratocarpa* (Decne.) Benth ex Clarke.	Ruta	Kunzum slope	4300-4500 m	S	H	Lf	Leaves extract is applied on cuts and wounds for healing.
24	*Jurinella macrocephala* (Royle) Aswal et Goel	Khamkai, Ruta	Kunzum slope	4200-4500 m	R	H	Wp, Lf	Whole plant is used for stomachache and diarrhea. Extraction of leaves is used on wounds and skin eruptions.
25	*Lactuca orientalis* (Boiss) Boiss.	Nechak	Tabo, Gette	3200-4300 m	C	Sh	Fl	Paste of flower is applied for body ache and headache.

S. No.	Taxa	Local name	Locality	Altitude range	Occ.	Life Form	Part Used	Traditional uses
26	*Lactuca macrorhiza* (Royle) Hook. f.	Thumpu	Gue,Gulling, Tackcha,, Sagnam, Guling	3700-4300	S	H	Ap	About ½ teaspoon powder of aerial part is taken for jaundice, headache and gastritis once in a day.
27	*Lactuca tatarica* (L.) C.A. Meyer.	Khala	Tabo, Langza	4200-4500	C	H	Wp	Decoction of whole plant is used for stomachache and joint pains.
28	*Leontopodium himalayanum* DC	Kheela	Kunzum slope, Takcha, Pin valley	3800-4550 m	C	H	Wp	A bunch of whole plants are made into a rounded cricket sized ball and the ball is used as acupressure to get relief from body stress and body ache. Extraction of plant is used to cure fever.
29	*Saussurea bracteata* Decne.	Pang-chi-towo	Pin valley, Demul	4360-4750 m	R	H	Inf	Decoction of flower head including bracts is given for fever, cold, stomachache and to improve blood circulation.
30	*Saussurea costus* (Falc.) Lipsch.	Kusth, Pachak	Mane	3600 m	-	H	Rt	Root powder is used for joint pains, asthma, bronchitis, cough and as blood purifier. Paste of root is used for wounds and skin problem.
31	*Saussurea jacea* (Klotz.) Clarke	Pang-chi	Silling, Kibber, Kaza, Ki	3150-4250 m	C	H	Inf, Wp	Smoke of inflorescence is inhaled for to get relief from asthma. Powder of whole plant is used for stomach problem.
32	*Scorzonera virgata* DC.	Chaktik	Kyoto, Hansa, Lossar, Kibber, Kaza, Ki	3300-4600 m	C	H	Ap	One teaspoon powder of aerial part is boiled in one liter water for 25-30 mint. Decoction is filtered and given for treatment of jaundice twice a day.
33	*Senecio chrysanthemoides* DC	Tungru medok	Chhota Dhara, Kunzum pass	3200-3800 m	S	H	Wp, Rt	Whole plant is used for fever and abdominal pain. Root paste is used for joint pain.

S. No.	Taxa	Local name	Locality	Altitude range	Occ.	Life Form	Part Used	Traditional uses
34	*Sonchus oleraceous* L.	-	Mane Yogma	3600 m	S	H	Ap	Extraction of aerial part is used for jaundice.
35	*Tanecetum dolichophyllum* (Kitamura) Kitamura	Khanpa	Mud	4150 m	S	H	Ap	Decoction of aerial part is used as vermifuge and for indigestion.
36	*Taraxacum officinale* Weber	Sarchen-Metok, khur-khang	Hurling, Kaza, Kibber	3000-4700 m	C	H	Ap, Rt	Powder of aerial part is given for cough, stomachache, constipation, throat infection and jaundice with lukewarm water once in a day. Root paste is used for joint pain. Root decoction used as liver tonic.
37	*Waldheimia glabra* (Decne.) Regel.	Phillu	Kunzum pass, Lossar	4000-4500 m	S	H	Wp	Paste of whole plant applied on cuts and wounds for healing.
38	*Waldheimia stoliczkai* Ostenf.	Lucmik-serpo	Gue	4600-4700 m	S	H	Fl	About 5-6 g powder of dried flowers used for food poisoning and coryza twice in a day.
39	*Waldheimia tomentosa* (Decne.) Regel.	Lukmik	Kunzum pass	4400-4750 m	S	H	Ap	About ½ teaspoon powder of aerial part is used for insomnias, food poisoning and backache once in a day.
40	*Youngia glauca* Edgew.	Seertik	Kunzum pass, Tabo, Dhankar	3500-4500 m	C	H	Ap	Half teaspoon powder of aerial part is used for indigestion, constipation, jaundice, fever and headache twice in a day.

Abbreviation: Ap: Aerial part, C: Common, Fl: Flower, H: Herb, Inf: Inflorescence, Lf: Leaves, Occ: Occurrences, R: Rare, Rt: Root, S: Scattered, Sh: Shrub, Wp: Whole plant.

Figure 1: Some ethnomedicnal plants of Asteraceae family of Spiti valley.

(a) *Achillea millefolium* L. (b) *Anaphalis triplinerus* (Spreng.) Hand. Mazz., (c) *Artemisia biennia* Willd., (d) *Artemisia capillaris* Thunb., (e) *Artemisia dracunculus* L. (f) *Breea arvensis* (L.)Less, (g) *Centaurea depressa* M. Bieb, (h) *Chrysanthemum pyrethoides* (Kir. & Kir.) B. Fedtsch., (i) *Cousinia* (k) *Lactuca orientalis* (k) *Lactuca macrorhiza* (Royle) Hook. f., (l) *Leontopodium himalayanum* DC., (m) *Scorzonera virgata* DC., (n) *Sonchus oleraceous* L., (o) *Waldheimia tomentosa* (Decne.) Regel. (p) *Youngia glauca Edgew*.

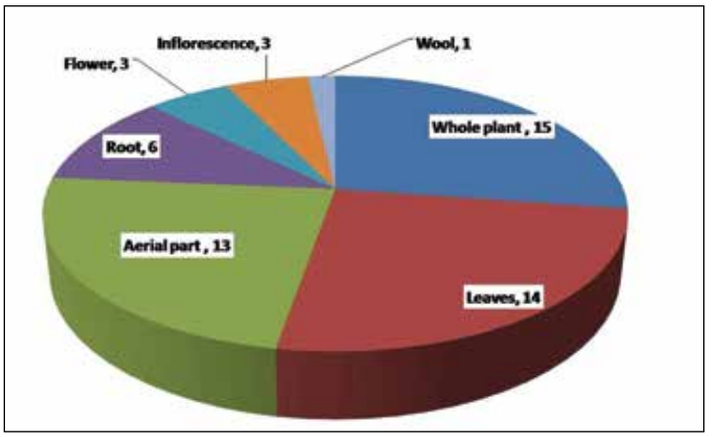

Figure 2: Pie diagram showing different plants part used for herbal medicine preparation

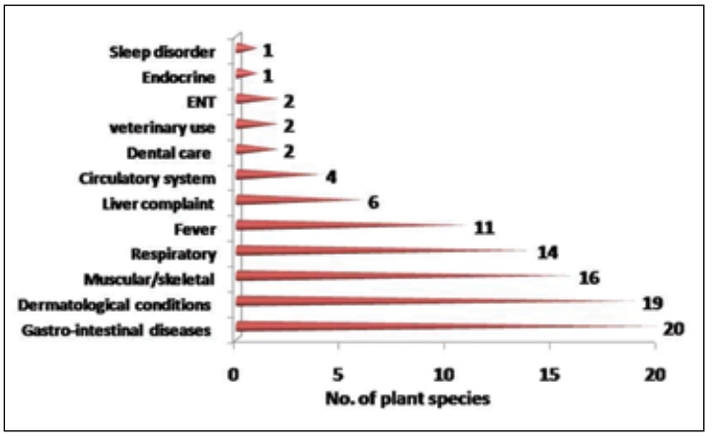

Figure 3: No. of plant species used to treat ailments within different ailment categories

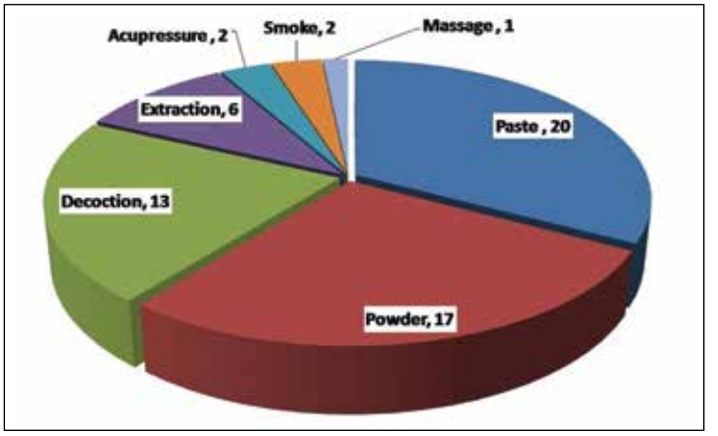

Figure 4: Different forms of herbal preparation of medicinal plant

Results and Discussion

During study it has been observed that that there is pretty well representation of members of family Asteraceae among the floristic wealth of alpine herbs. These

plants flourish during summer months and are harvested before the winter starts. They have widely distributed in all altitude range with the upper limit reaching the snow line. These herbs of Asteraceae come across those medicinal plants which serve as life line of inhabitants living in severely cold alpine zone of Spiti valley. In the present study 40 species belonging to 24 genera belonging to Asteraceae family are collected that are being used by Bhotia tribe for their ethno medicinal uses (Table 1 & Fig. 1). Most of species are herbs (38 sps.) followed by shrubs (2 sps). Different parts of medicinal plant species are used as a medicine. Most frequently used plant parts are whole plant (15 sps.) followed by leaves (14 sps.), aerial part (13 sps.), root (6 sps.), flower & inflorescence (3 sps. each), wool (1 sps.) (Fig. 2). About 90% of plant species are extracted from the wild which are used in the herbal industries, and about 70% of the medicinal plants of Indian Himalaya are subject to destructive harvesting (Bhat, *et al*., 2013; Dhar, *et al*., 2000; Singh and Dey, 2005). Therefore local people should be educated for sustainable use and utilization of medicinal plant parts especially when whole plant, root and reproductive parts are used for herbal preparation. Distribution status of plant species show that majority of species are scattered (23 sps.) followed by common (13 sps.) and rare (2 sps.). Though *Erigeron multiradiatus* (DC). Benth.ex Clarke, *Erigeron acer* L., *Erigeron alpinus* L., *Crepis sancta* L., *Lactuca tatarica* (L.) C.A. Meyer., *Leontopodium himalayanum* DC, *Scorzonera virgata* DC. are weeds but tribal people utilized them as medicines. Most of species are collected from wild; however two species viz. *Inula racemosa* Hook.f and *Saussurea costus* (Falc.) Lipsch. collected in cultivated form as they was cultivated by *Amchi* at Mane village for medicinal purpose. The flora of Spiti is threatened by such factors as grazing, habitat destruction, over exploitation and unsustainable picking. Therefore, rare and scattered plant species needs the conservation strategy as their unscientific and over-exploitation extraction could leads permanent disappear of species in nature for future use.

These ethno medicinal plants are used to cure various ailments in different ailment categories viz., Gastro-intestinal diseases (gastric problem, stomachache, food poisoning , Vermifuge, indigestion, constipation, diarrhea, gastritis); dermatological conditions (cuts and wounds, burns, boils, skin eruption); fever (common fever); respiratory (pneumonia asthma chronic bronchitis throat infection cough and cold); liver complaint (jaundice, liver tonic); Circulatory system *(*blood pressure, blood blockage, blood circulation, blood purifier) dental care (toothache); ENT (stop nose bleeding, coryza); endocrine (diabetes); sleep disorder (insomnias). Two species are used for wound healing and stomach complaint in livestock (Fig. 3). Paste, decoction, extraction, powder are generally the preparation method of herbal medicine; other preparations are smoke, acupressure and massage (Fig. 4). Local inhabitants and herbal man collected these species and after drying they use them during the whole seasons of the year. However for paste

formation fresh plant is mostly preferred. Smoke of plant is inhaled mostly for asthma problem. Some time whole plant or plant cotton wool is used to produce acupressure in body to cure ailment.

The study highlighted the importance of Asteraceae family as a potential source of medicinal plants and make significant contributions to indigenous ethnobotanical knowledge as well as the studies of the sourcing of raw materials for the development of commercial pharmaceuticals for further ethno-pharmacological study. Literature review showed that curative properties of these plants are described by different parts of the world in the treatment of the same or similar diseases. Similarly most of these species are found to be widely used in Ayurveda, Unani, Siddha, Homeopathy and other folk systems of Indian Medicine (Ambasta, 1986; Jain, 1991; Khare, 2007; Kirtikar and Basu, 1935 and Pullaiah, 2002). Similar use of the plants species to treat the same disease in different places across the world gives indication of their curative properties, thus their pharmacologic effect could be accepted. It is also found that some medicinal use of species viz. *Artemisia maritima* L. *Centaurea depressa* M. Bieb, *Cousinia thomsonii* C.B.Clarke, *Lactuca macrorhiza* (Royle) Hook. f., *Saussurea bracteata* Decne., are rare and less known. Therefore, there is a need to re-investigate all these folk medicinal species for their chemical constituents and pharmacological activity in an effort to discover new drugs of plant origin.

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Ethnomedicinal Uses of Plants of Kendrapara District, Odisha : A Contribution

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Abstract

Different coastal areas of the district Kendrapara were explored during February 1999 and 2001 for its medicinal plant wealth and documentation of medicinal uses from local people. The delta in the district is famous for higher concentration of mangrove elements. Only a few places like Jambu, Rajkanika and Rajnagar, have some mangroves and their associates such as *Ceriops decandra, Derris trifoliata, Excoecaria agallocha, Hibiscus tiliaceous* etc. and remain as past mangrove forest. This paper provides a brief account of 42 folk medicinal uses of 35 plant species used by the native inhabitants of Kendrapara district, Odisha for alleviating their common health problems. Most of the therapeutic uses were found to be new or less known when compared with published literature on ethnomedicine of India.Some of the species worth mentioning for their medicinal uses are *Acanthus illicifolius* in asthma, *Basilicum polystachyon* in eye complaints, *Ceriops decandra* in fever, *Enydra fluctuans* in night blindness, *Hibiscus tiliaceous* in earache and *Merope angulata* in cold and cough are noteworthy.

Key words: Ethnomedicine, Kendrapara, Mangroves, Medicinal plants.

Introduction

Kendrapara - one of the 30 districts of Odisha is situated between 20º 22' - 20º 50'N latitude and 86º 17'' -87º 0' E longitude in Mahanadi delta on the Eastern Coast of India. It is bounded on the North by Baitarni and Dhamra rivers, on the East by Bay of Bengal , on the South by Mahanadi and on the West by Cuttack and Jajpur district of Odisha. The temperature ranges from 36º-21º. April and January are the hottest and coldest months respectively. The annual rainfall is 140.6cm. The soil types are sandy in the fringes of the coast and alluvial silty along the river mouths.

The Mahanadi delta in the district has been famous for higher concentration of mangrove elements in the past. This has been degraded considerably due to habitat destruction, biotic interferences and super cyclone- that hit the Odisha Coast in October, 1999 which resulted not only in heavy loss of lives but considerable vegetation cover. Only at few places like Jambu, Rajkanika and Rajnagar, some mangroves and their associates such as *Ceriopes decandra, Derris trifoliata, Excoecaria agallocha, Hibiscus tiliaceous* etc. remains as past mangrove forest. Besides mangrove associates, the district is rich in aquatic and marshland vegetation. Occasional patches of thorny shrubs are also seen at some places.

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Sporadic reports on the flora of this region are available in published literature (Das *et al*., 1994; Saxena and Brahmam, 1994-96). An account of 36 species as potential medicinal plants of Mahanadi delta has been published (Subudhi *et al*., 1992). Based on the available reports. However, Kendrapara district has remained neglected for study on its ethnobotany including traditional knowledge on local medicinal plant resources.

In the present study, medicinal species have been documented which are commonly used in native phytotherapy in the study also. Only those species whose folk uses were found to be new or interesting have been recorded and compared with available literature (Jain,1991; Jain *et al*., 1991; Subudhi *et al*., 1992; Girach *et al*., 1994, 1996, 1998; Verghes,1996; Rama Rao and Henry,1996; Pal and Jain, 1998; Kaushik and Dhiman, 1999; Girach and Aminuddin, 2005; Girach, 2007; Ali *et al*., 2010; Aminuddin *et al*., 2010; Girach and Aminuddin, 2010; Mohanty *et al*., 2011; Rout and Panda, 2010; Panda and Misra,2011; Sahu *et al*., 2011; Singh and Shweta, 2012) are enumerated in the present report.

Methodology

Medicinal plants collection trips were made to different localities in the study area during February - March 1999 and February 2001. Ethno-medicinal information on available plant species were gathered from local herbalists and other knowledgeable persons through personal interviews. The method of study was generally same as described by Jain (1965). Information was cross - checked from other localities / group of people whenever possible. Botanical specimens were collected with the help of local informants to make sure that specific plant was obtained and botanically identified and preserved in the Herbarium of Regional Reseach Institute of Unani Medicine, Bhadrak. Nomenclature of plant species is based on Flora of Orissa *(*Saxena and Brahmam, 1994-1996).

Enumeration of Medicinal Plants

Medicinal plants are arranged alphabetically followed by plant family in bracket, local name (LN), locality (Loc*)* , name of informant (I), voucher specimen number, availability in the area and folk medicinal uses .

Abroma augusta L. (Sterculiaceae), LN: Ulatkarnal, Loc: Patkura, I: Das, 6825.

Occasionally planted near villages.

A few pieces of stem bark are soaked overnight in sufficient quantity of water, filtered and taken in the morning on empty stomach to treat dysentery.

Abutilon indicum (L.) Sweet *(*Malvaceae), LN: Pedipedika, Loc: Barimul, I:Mallik, 6093.

Common in waste places.

Decoction of fresh leaves (two teaspoon, twice daily) is taken twice a day for one week to treat jaundice.

Acacia farnesiana (L.) Willd. (Mimosaceae) , LN: Gandha baburia, Loc: Bhuinpur, I:Mrs.Satpathy, 6311.

A small piece (5cm) of stem bark is tied as an amulet on the arm of children in psychosomatic disorder.

Acanthus illicifolius L. (Acanthaceae), LN: Harkachh, Loc: Jambu, I:Pati, 6253.

Common in coastal mangrove forest.

Leaf decoction *(*one teaspoon, two times daily) is given with honey to check recurrent asthmatic attacks. Crushed leaf juice is applied locally on cuts to check bleeding.

Ageratum conyzoides L. *(*Asteraceae*)*, LN:Pokosunga, Loc: Patrapur, I:Maharana, 6345.

Occasional weed of waste and moist places.

Crushed stem is placed in dental cavity to treat toothache.

*Alstonia scholaris (*L.) R.Br. *(*Apocynaceae), LN:Chatuan, Loc: Patrapur, I: Das, 6342.

Usually planted on road side.

Fresh latex is applied locally on boils for suppuration. Stem bark made into thin paste is uniformly applied to heal broken bones. The treatment is repeated every third day till cure.

Amaranthus spinosus L. (Amaranthaceae), LN: Kanta neutia, Loc: Palaspur, I: Mahapatra, 6264.

Common weed of waste places.

A handful of fresh roots together with Aloe vera (Gheekunwar) and *Cissus quadrangularis* (Hadbhanga) are made in to thin paste and applied uniformly to join broken bones. The treatment is repeated frequently depending upon healing progress.

Anacardium occidentale L. (Anacardiaceae), LN: Kaju badam, Loc: Phulwar, I:Jena, 6367.

Cultivated to a small extent in Phulwar and other areas of study area.

Seed oil is applied locally on water born skin infection, while working in water logged fields.

Basilicum polystachyon (L.) Moench. *(*Lamiaceae), LN: Tokamari, Loc: Kauguda, I: Rana, 6383.

Frequent in moist waste places.

Mature fresh seeds are placed in eye. Seeds are stated to swell with eye fluid and remove impurities like foreign particle.

Blumea lacera (Burm. f.) DC. *(*Asteraceae), LN: Hemraj, Loc: Jharia, I: Patra,6381.

Common in waste places.

Plant made in to paste is applied locally to subside swelling.

Ceriops decandra (Griff.) Ding. *(*Rhizophoraceae), LN: Gharan, Loc: Jambu, I: Das, 6277.

One of the true mangroves in Jambu region of the district.

Root decoction *(*one teaspoon, two times daily) is given to alleviate fever.

Clerodendrum inerme (L.) Gaertn. *(*Verbenaceae), LN: Gangjhepa, Loc: Jambu, I: Das,6252.

One of the common associates of mangrove forest.

Crushed leaves are applied locally on wounds for healing . Leaf juice is applied on forehead to get relief from headach. Leaf juice (one teaspoon, a day) with honey is given to alleviate fever.

Clerodendrum viscosum Vent. (Verbenaceae), LN: Kumuti, Loc: Gopinathpur, I: Mahapatra, 6290.

Common in scrub forests and waste places.

Extracted leaf juice with Kalanchoe pinnata (Amarpoi) leaf juice is drunk *(*one teaspoon, two times daily) to treat blood dysentery.

Clitorea ternatea L. *(*Fabaceae), LN: Aparajita, Loc:Mirgnaini,I:Patel,6332.

Ocassional in hedges.

Extracted leaf juice is poured in eyes as drops to treat stye.

Coccinia grandis (L.) Voigt. *(*Cucurbitaceae), LN: Kumaita, Loc: Manikunda, I: Rath, 6820.

Common among bushes near villages, also largely cultivated for its edible fruits.

A few dried leaves made in to powder with two black peppers is given with honey (3-5g, two times daily) to treat diarrhoea.

Cuscuta reflexa Roxb.*(*Cuscutaceae), LN: Nirmuli, Loc: Damarpur, I:Tripathy, 6354.

Occasional on shrubs and small trees as parasitic twinner, specially *on Acacia nilotica* in the area. Plant is boiled in *Ricinus communis* (Jado) oil and this oil is applied on scalp to treat hair loss.

Derrris trifoliata Lour. *(*Fabaceae), LN: Kniali, Loc: Jambu, I: Das,6269.

Occasional climber in mangrove forests.

Crushed leaves are applied on cuts to check bleeding.

Enydra fluctuans Lour. *(*Asteraceae), LN: Hidmicha, Loc: Gopinthpur, I:Arjun sethi.6391.

One of the common floating hydrophytes in ponds and ditches.

Leaf juice is used as eye drops to treat eye complaints. Leaf paste is applied locally on scabies. Powdered dried plant is given *(*5-10g , two times daily) to treat abdominal disorder. Plant is eaten raw or cooked to treat night blindness. Crushed plant is applied on scalp to treat insanity. Plant decoction in desired quantity is given 2-3 times daily for about one week to treat jaundice.

Exocoecaria agallocha L. (Euphorbiaceae), LN: Gowan, Loc: Jambu, I:Jena, 6275.

Common latex bearing tree in mangrove forests.

Fresh stem bark made in to paste is applied directly on wounds for healing.

Fioria vitifolia (L.) Mattei (Malvaceae), LN: Pedipedika, Loc: Kendrapara, I: Khan, 6815.

Occasional in waste grounds during rainy seasion.

3-7 leaves (depending upon age of the patient) are given once daily, to treat jaundice.

Glinus lotoides L. (Molluginaceae), LN: Kadua, Loc: Jadupur, I: Das, 6758.

Occasionally found in moist and waste plces.

Plant decoction *(*one teaspoon full, two times daily) is given to treat diarrhoea.

Glycosmis pentaphylla (Retz.) DC. (Rutaceae), LN: Chauldhua, Loc: Mahakalpada, I: Mohanty, 6263.

Common in scrub forest.

Crushed leaves are applied fresh locally to treat scabies.

Grangea maderaspatana (L.) Poit. (Asteraceae), LN:Namuti, Loc: Barimul, I: Mallik, 6397.

Occasional in moist places.

Dried powder of leaves is inhaled through nose for sneezing purpose to get relief from severe cold and headache.

Heliotropium indicum L. (Boraginaceae), LN: Hathisunda, Loc: Bhuinpur, I: Rana, 6310.

Occasional in moist paces.

Freshly extracted leaf juice is given *(*two teaspoon, two times daily*)* to treat dysentery with bloody stools.

Hibiscus tiliaceous L. (Malvaceae), LN: Baniah, Loc: Jambu, I: Rath, 6256.

One of the common tree in mangrove forest areas.

Fresh flower juice is poured warm in ear to treat earache.

Hybanthus enneaspermus (L.) F.V. Muell. (Violaceae),LN:Madanmastak, Loc:Dia, I: Maharana, 6743.

Occasional in open grassy places.

Plant decoction *(*one teaspoon, two times daily) is given to alleviate fever.

Hyptis suaveolens (L.) Poit. (Lamiaceae), LN: Bantulsi, Loc: Chandibazar, I : Sahu, 6297.

Ocacasional near villages and waste places.

Smoke of dried plant is used as insect repellant to keep mosquitoes away.

Jatropha gossypifolia L. (Euphorbiaceae), LN: Nali amarjada, Loc: Gogua, I:Das, 6722.

Common in waste places and among hedges.

A handful of root bark fried in cow ghee is made into paste and applied locally to heal and join broken bones.

The treatment is repeated every third day till fully recovered.

Justicia gendarussa Burm.f. (Acanthaceae), LN: Kodabasango, Loc: Tulsipur, I: Mrs. Pati, 6858.

Planted as hedge in some villages.

Stem bark decoction (one teaspoon, two times daily) is given with curd to treat diarrhoea.

Lippia javanica (Burm. f.) Spreng. *(*Verbenaceae), LN: Gandhagadia, Loc: Palaspur, I: Sahu, 6267.

Occasional in moist places.

A handful of dried leaves powdered with 2-5 black pepper is given *(*3-5 g, two times daily) to treat diarrhoea.

Merope angulata (Kurz) Swingle *(*Rutaceae),LN: Ban nimbu,,Loc; Jambu, I:Mahapatra, 6254.

Occasional among bushes in mangrove forests.

Extracted fruit juice mixed with mother's milk is given half teaspoon thrice daily, to infant against cough and cold.

Morinda pubescens Sm. *(*Rubiaceae), LN: Achhu, Loc: Patkura, I:Sahu, 6824.

Commonly planted near residential areas in villages.

A handful of leaves are made in to paste with desired quantity of Curcuma longa (Haldi) and applied on the body of newly born baby to treat physiological jaundice locally known as Rangbat.

Murdannia nudiflora (L.) Brenan *(*Commelinaceae), LN: Kanisiri, Loc: Jharia, I: Mrs. Senapati , 6379.

Occasional in wet moist lands near streams, ponds etc.

Extracted leaf juice (fresh) is used as eye drop to remove foreign particles from eye and subside redness.

*Rorippa indica (*L.) Hiern *(*Brassicaceae) LN: Bansariso Loc: Barimul, I: Mallik, 6399.

Rare in the area. Collected only once from moist and waste area near stream.

Leaf paste is applied fresh on forehead to treat headache.

Solanum virginianum L. *(*Solanaceae), LN: Akranti, Loc: Gopinathpur, I:Mahapatra, 6314.

Occasional in dry open places.

A handful of dried plant with equal quantity of Caeslpinia bonduc (Gilo) seed kernal is powdered and given *(*10 g , twice daily) to treat oedematous swellings in filariasis.

Results and Discussion

A total of 42 information on 35 plant species used in traditional folk medicine by local people of Kendrapara district, Odisha, have been presented. Scrutiny of published literature reveals that out of 42 uses, 31 medicinal uses of 20 medicinal plants taxa are not reported earlier (Jain, 1991). Some of these are *Abroma augusta* L. to treat dysentery; *Derrris trifoliata* Lour. applied on cuts*; Enydra fluctuans* Lour. for abdominal pain night blindness and insanity*; Exocoecaria agallocha* L. for wounds healing; *Fioria vitifolia* (L.) Mattei to treat jaundice; *Glinus lotoides* L. to treat diarrhea*; Hibiscus tiliaceous* L. to treat ear ache*; Lippia javanica* (Burm. f.) Spreng. to treat diarrhea*; Rorippa indica (*L.) Hiern to treat

head ache and few others. While few medicinal plant species and their uses e.g. *Acanthus illicifolius* L., *Basilicum polystachyon* (L.) Moench., *Ceriops decandra* (Griff.) Ding., *Derrris trifoliata* Lour. and *Merope angulata* (Kurz) Swingle are not even mentioned and reported in the dictionary of Jain (1991). Thus, only few uses are found common and reported when cross checked with the dictionary of Jain (1991). Some of the species are quiet popular as medicinal in the region. Among these *Enydra fluctuans, Clerodendrum inerme* are noteworthy. Further, biodiversity of coastal wetlands and Mahanadi delta is always under constant threat due to habitat destruction, biotic interferences, developmental activities such as construction of shelters, schools, roads etc. for cyclone affected people of coastal Odisha and prawn culture. There is, therefore, an urgent need to develop strategies for conserving valuable diversity and sustainable use of available natural plant resources.

Conclusion

We suggest detailed phytochemical, pharmacological and clinical investigations of all these folk medicinal species in the context of their reported claims in an effort to discover new drugs of natural origin. The study may provide clue to conservation biologists and ecologists to plan strategies for development of coastal wetlands including fast disappearing mangrove forest.

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Pharmacognostic Profiles on Root & Rhizome Drugs: A Bibliographic Review

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Abstract

The present communication review the publications (pharmacopoeia, monographs, books etc.) on pharmacognostic aspects of root and rhizome drugs. This review is presented in bibliographic format for references. Bibliographiesare important tool of published literature on any aspect of past and present status of knowledge on a specified subject. These are considered the key to initiate research in any field and provide lead towards further work in a defined field.

Key words: Bibliography, Pharmacopoeia, Pharmacognosy of root and rhizome, Herbal drugs.

Introduction

The Materia Medica of Ayurvedic, Siddha, Unani and Homoeopathic systems of medicine prescribe major source of drugs from herbal origin. To derive the herbal drugs various morphological parts of a plant species viz leaves, stem, root, barks, heartwood, flowers, fruits, seeds and various exudates are collected and resourced by the manufactures to formulate the medicines of these systems. It is estimated that more than 960 medicinal plant species are the source of 1289 botanical raw drugs in trade in this country (Ved and Goraya, 2008).In pharmaceutical practices the term 'root and rhizome' refers to dried underground parts of plant. Driedroot and rhizome drugs morphologically resemble each other which leads to confusion leading to fair chances for adulteration. However, organoleptic characteristics can be observed in root and rhizomerelated to its type, shape, size, surface (inner and outer), colour, odour, taste, fracture etc. for identification purposes. Pharacognostic profiles explain diagnostic characteristics ofdrug so as to authenticate and differentiate from adulterants or substitutes.

Bibliographies explicit the literature published so far in respective area. Major existing bibliographies on the Pharmacognostic aspects (Iyengar, 1976 and Mitra, 1985) and relevant available sources have been consulted (Rai *et al*, 2012; Tiwari *et al*, 2013). Pharmacopoeias (regulatory standards) and monographic work are listed as these works are pertinent to pharmacognostical profiles on herbal drugs which can be referred to evaluate root and rhizome drugs in a quality control laboratory. Research publications on this aspect are not included in present review.

Bibliographic Review

The tables 1 and 2 enumerate the root and rhizome drugs and citations (acronym) for their references in literature. Acronyms are explained at the last of the

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bibliographic references given after the tables.

1. Pharmacopoeial Review : Indian Pharmacopoeial publications are regulatory books under Drug & Cosmetic Act 1940 and Rules thereunder. Quality standards on herbal drugs comprise standards on identity, purity and strength. Identity of herbal drugs in a pharmacopoeia is ensured by pharmacognostical profile viz macroscopic and microscopic characteristics of drug. Pharmacopoeial monographs on herbal drugs of root and rhizome origin are enumerated in Table -1

Table 1: Pharacognostic work on Root and Rhizome drugs in Pharmacopoeial references

Sl. No.	Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
1	*Abroma augusta* Linn.	Abroma radix	Root	HPI- IV
2	*Abrus precatorius* L.	Gunja	Root	API- II
		Ghongchi	Root	UPI-IV
3	*Abutilon indicum* (L.) Sweet.	Atibala	Root	API- I
4	*Acalypha fruticosa* Forsk.	Laghu haritamanjari	Root	API- VI
		Cinni ver	Root	SPI-II
5	*Acalypha indica* L.	Harita manjari	Whole plant	API- VI
		Kuppaimeni camulam	Whole plant	SPI-II
		Acalypha indica	Whole plant	HPI-I&VIII
6	*Acer negundo* Linn.	Negundium americana	Whole plant	HPI-VII
7	*Achillea millefolium* Linn.	Millefolium	Whole plant	HPI-IV
8	*Achyranthes aspera* L.	Apamarga	Root	API- III
		Chirchita	Root	UPI-IV
		Apamarga	Whole plant	API- II
		Nayuruvic camulam	Whole plant	SPI-I
9	*Aconitum chasmanthum* Stapf ex Holmes	Vatsanabha	Root	API- II
		Aconiturn, Aconite	Dried root	IPL, IP 55
		Beesh	Root	UPI-IV
10	*Aconitum ferox* Wall.	Aconitum ferox	Root	HPI-VII
11	*Aconitum heterophyllum* Wall ex.	Atees Shireen	Dried root	UPI-I
		Ativitayam	Root	SPI-I
12	*Aconitum lycoctonum* Linn.	Aconitum lycoctonum	Whole plant	HPI-VI
13	*Aconitum napellus* L.	Aconite	Dried root	IP 66
		Acontium napellus	Whole plant	HPI-I
14	*Acorus calamus* L.	Vaca	Rhizome	API- II
		Waj Turki	Rhizome	UPI-V
15	*Actaea spicata* L.	Actaea spicata	Root	HPI-IV
		Astacus spicata	Root	HPI-VI
16	*Adhatoda zeylanica* Medic.	Vasa	Root	API- IV
17	*Adiantum capillus- veneris* L	Bijapatra	Whole plant	API- VI

18	*Adiantum lunulatum* Burm.	Hamsapadi	Whole plant	API- III
19	*Adonis vernalis* Linn.	Adonis vernalis	Whole plant	HPI-II
20	*Aegle marmelos* (L.) Corr.	Vilva ver	Root	SPI-I
		Bilva	Root	API- III
21	*Aerva lanata* (L.) Juss. ex Schult.	Cirupilaic camulam	Whole plant	SPI-I
		Pattura	Whole plant	API- V
22	*Aethusa cynapium* Linn.	Aethusa cynapium	Whole plant	HPI- I&VIII
23	*Agraphis nutans* Linn.	Agrarphis nutans	Whole plant	HPI-VI
24	*Agropyrum repens* Beauv.	Triticum repens	Rhizome	HPI-III
25	*Aletris farinosa* Linn.	Aleteris farinosa	Rhizome	HPI-II
26	*Alhagi pseudalhagi* (Bieb) Desv.	Jawansa	Whole plant	UPI-VI
		Yavasaka	Whole plant	API- II
27	*Allium ursinum* Linn.	Allium ursinum	Whole plant	HPI-VIII
28	*Alpinia calcarata* Rosc.	Granthimula	Rhizome	API- VI
29	*Alpinia galanga* Willd.	Kulanjana	Rhizome	API- V
		Perarattai	Rhizome	SPI-I
		Khulanjan	Rhizome	UPI-II
30	*Alpinia officinarum* Hance	Rasna	Dried rhizome	IP 66
31	*Alstonia scholaris* Wall. ex Royle	Ativisa	Root	API- I
32	*Alternanthera sessilis* (L.) R.Br.,ex DC.	Ponnankani	Whole plant	SPI-I
		Matsyaksi	Whole plant	API- II
33	*Althaea officinalis* L.	Khatmi	Root	API- V
		Bekh khatmi	Root	UPI-V
		Althea officinalis	Root	HPI-VII
34	*Amaranthus tricolor* L.	Ramasitalika	Whole plant	API- III
35	*Ammi majus* Linn.	Ammi majus	Whole plant	HPI-IX
36	*Anacyclus pyrethrum* DC.	Akarakarabha	Root	API- II
		Akkarakaram	Root	SPI-II
		Aaqarqarha	Root	UPI-II
37	*Anagallis arvensis* Linn.	Anagalllis arvensis	Whole plant	HPI-IV
38	*Andrographis paniculata* Nees	Andrographis paniculata	Whole plant	HPI-I
39	*Anemone hepatica* Linn.	Hepatica triloba	Whole plant	HPI-IX
40	*Angelica archangelica* Linn.	Canda	Root	API- V
		Angelica archangelica	Root	HPI-IX
41	*Angelica glauca* Edgew	Coraka	Root	API- V
42	*Anisomeles malabarica* (L.) R.Br. ex. Sims.	Sprkka	Whole plant	API- VI
43	*Anthamanta oreoselinum* Linn.	Anthamantha oreoselinum	Whole plant	HPI-VI
44	*Anthoxanthum odoratum* Linn.	Anthoxanthum odoratum	Whole plant	HPI-IV&VIII
45	*Apium graveolens* L.	Karaphsa	Dried root	API- VI

46	*Apocynum androsaemifolium* Linn.	Apocynum androsaemifolium	Rhizome	HPI-III
47	*Apocynum cannabinum* Linn.	Apocynum cannabinum	Rhizomes	HPI-I&VII
48	*Aralia racemosa* Linn.	Aralia racemosa	Root	HPI-I&IX
49	*Arcthum major* Bernh.	Lappa major	Root	HPI-III
50	*Argemone mexicana* Linn.	Argemone mexicana	Whole plant	HPI-IX
51	*Argyreia nervosa* (Burm.f.) Boj. syn. *Argyreia speciosa* Sweet	Basthantri/ Akarakarabha	Root	API- V
52	*Arisaema triphyllum* Schott.	Arum triphyllum	Root	HPI-I
53	*Arisaeme dracontium* Schutt.	Arum dracontium	Root	HPI-IV
54	*Aristolochia clematitis* Linn.	Aristolochia clematitis	Root	HPI-IV
55	*Aristolochia indica* Linn.	Isvari	Root	API- III
		Zarawand Hindi	Root	UPI-V
56	*Aristolochia serpentaria* Linn.	Aristolochia serpentaria	Root	HPI-III&VII
57	*Arnica montana* Linn.	Arnica montana	Whole plant	HPI-I
58	*Artemisia absinthium* L.	Dvipantara damanaka	Whole plant	API- VI
59	*Artemisia vulgaris* Linn.	Artemisia vulgaris	Root	HPI-I&IX
60	*Artocarpus heterophyllus* Lamk	Panasa	Root bark	API- VI
61	*Arun maculatum* Linn.	Arum maculatum	Root	HPI-IV
62	*Arundo donax* Linn.	Arundo donax	Whole plant	HPI-IX
63	*Asarum canadense* Linn.	Asarum canadensis	Rhizome	HPI-II
64	*Asarum europaeum* L.	Pindatagara	Rhizome	API- VI
		Asaroon	Rhizome	UPI-VI
		Asarum europaeum	Whole plant	HPI-IV
65	*Asclepias curassavica* Linn.	Asclepias curassavica	Whole plant	HPI-IX
66	*Asclepias incarnata* Linn.	Asclepias incarnata	Root	HPI-VI
67	*Asclepias tuberosa* Linn.	Asclepias tuberosa	Root	HPI-III&VII
68	*Asparagus officinalis* L.	Dvipantara Satavari	Root	API- VI
69	*Asparagus recemosus* Willd.	Tannirvittan kilanku	Tuberous root	SPI-II
		Shatavari, Asparagus racemosus Root	Tuberous root	IP 2007, IP 2010, IP 2014
		Satavari	Root	API- IV
		Satawar	Tuberous root	UPI-VI
70	*Asteracantha longifolia* Nees.	Kokilaksa	Root	API- II
		Kokilaksa	Whole plant	API- II
		Hygrophilla sfinosa	Whole plant	HPI-IX
		Belladonnae radix, belladonna root	Dried root and Root stock	IP 55
71	*Atropa belladonna* Linn.	Belladonna	Whole plant	HPI-I

72	*Azadirachta indica* A.Juss.	Nimba	Root bark	API- V
		Neem	Root bark	UPI-V
73	*Bacopa monnieri* (L.) Penn. (Wettst)	Brahmi	Whole plant	API- II
		Pirammi valukkai	Whole plant	SPI-I
		Bacopa monnieri	Whole plant	HPI-IX
		Jal Brahmi	Whole plant	UPI-IV
74	*Baliospermum montanum* Muell.-Arg.	Danti	Root	API- III
75	*Baptisia australis* (Linn.) R. Br.	Baptisia confusa	Whole plant	HPI-VII
76	*Baptisia tinctoria* Vent.	Baptisia tinctoria	Root bark	HPI-I & IX
77	*Barleria prionitis* Lees.	Sahacara	Whole plant	API- III
78	*Barleria strigosa* Willd.	Nilajhinti	Root	API- V
79	*Bellis perennis* Linn.	Bellis perennis	Whole plant	HPI-I & IX
80	*Berberis aquifolium* Pursh.	Berberis aquifolium	Root	HPI-III
81	*Berberis aristata* DC	Berberis	Dried root with the bark intact	IPL
		Daruharidra Root Berberis; Berberis aristata	Dried root	IP 2010, IP 2014
82	*Berberis vulgaris* Linn.	Berberis vulgaris	Root bark	HPI-I
83	*Bergenia ciliata* (Haw.) Sternb.	Pasana Bheda	Rhizome	API- I
84	*Beta vulgaris* Linn.	Beta vulgaris	Root	HPI-IX
85	*Boerhaavia diffusa* L.	Raktapunarnava	Root	API- III
		Punarnava (Rakta)	Whole plant	API- I
		Mukkirattaic camulam	Whole plant	SPI-I
		Boerhaavia diffusa	Whole plant	HPI-I
		Punarnava Hogweed; Boerhaavia diffusa	Dried root	IP 2007, IP 2010, IP 2014
86	*Boerhaavia verticillata* Poir	Sveta punarnava	Root	API- V
87	*Bryonia alba* Linn.	Bryonia alba	Root	HPI-I & IX
88	*Bryonia cretica* L. sub sp. *dioica* (Jacq.) Tutin	Bryonia cretica	Root	HPI-VIII
89	*Cajanus cajan* (L.) Millsp.	Adhaki	Root	API- III
90	*Caladium segulnum* Vent	Caladium seguinum	Whole plant	HPI-IV
91	*Calamus rotang* L.	Vetra	Rhizome	API- VI
		Pirappan Kilanku	Rhizome	SPI-II
92	*Calamus thwaitesii* Becc.	Kumarivetra	Rhizome	API- VI
93	*Calotropis gigantia* R.Br.	Calotropis gigantea	Root	HPI-I
94	*Calotropis procera* (Ait.) R. Br.	Arka	Root	API- I
		Madar	Root bark	UPI-IV
95	*Caltha palustris* Linn.	Caltha palustris	Whole plant	HPI-V & VIII

96	*Calycopteris floribunda* Lam.	Pullani	Root	API- V
97	*Caphaelis ipecacuanha* (Brot.) A Rich	Ipecacuanha	Root	HPI-I
98	*Capparis spinosa* L.	Himsra	Root	API- V
		Kibr	Root	UPI-V
99	*Capsella bursa pastoris* Moench.	Thlapsi bursa pastoris	Whole plant	HPI-V
100	*Cardiospermum halicacabum* L.	Karnasphota	Root	API- V
101	*Carica papaya* L.	Eranda karkati	Root	API- VI
102	*Carissa carandas* L.	Karamarda	Root	API- III
103	*Cassia sophera* Linn.	Cassia sophora	Root	HPI-VI
104	*Catharanthus roseus* Linn.	Catharanthus roseus	Whole plant	HPI-IX
105	*Caulophyllum thalictroides* Michx	Caulophyllum thalictroides	Rhizome	HPI-I & VIII
106	*Centaurea behen* L.	Behman Safed	Dried root	UPI-III
107	*Centaurium chielense* (Pers.) Druce.	Canchalagua	Whole plant	HPI-VIII
108	*Centella asiatica* (L.) Urban	Mandukaparni	Whole plant	API- IV
		Hydrocotyle asiatica	Whole plant	HPI-I
109	*Cephaelis ipecacuanha* A. Rich; *C. acuminata* Karsten	Ipecac Tincture, Cephaelis ipecacuanha	Root and rhizomes	IP 55, IP 66, IP 2010, IP 2014
110	*Chamaelerlum luteum* (Linn.) A. Gray	Helonias dioica	Rhizome	HPI-III
111	*Chamomilla recutita* (L.) Rauschert.	Chamomilla	Whole plant	HPI-I & V
112	*Cheiranthus cheiri* Linn.	Cheiranthus cheri	Whole plant	HPI-VIII
113	*Chelidonium majus* Linn.	Chelidonium majus	Whole plant	HPI-I & VIII
114	*Chelone glabra* Linn.	Chelone glabra	Whole plant	HPI-IV&VIII
115	*Chimaphila maculata* Pursh.	Chimaphila maculata	Whole plant	HPI-VII
116	*Chimaphila umbellate* (Linn.) Barton.	Chimaphila umbellata	Whole plant	HPI-II&VIII
117	*Chlorophytum arundinaceum* Baker	Musli Safaid	Root	UPI-II
118	*Chondodendron tomentosum* Ruiz et. Pavon.	Palladium	Root	HPI-V
		Pareira brava	Root	HPI-III
119	*Cicer arietinum* L.	Canaka	Whole plant	API- VI
120	*Cichorium intybus* Linn.	Cichorium intybus	Root	HPI-IX
121	*Cicuta maculata* Linn.	Cicuta maculata	Root	HPI-IX
122	*Cicuta virosa* Linn.	Cicuta virosa	Root	HPI-I & VIII
123	*Cimieifuga racemosa* Nutt.	Cimicifuga racemosa	Rhizome	HPI-I

124	*Cissampelos pareira* L.	Patha	Root	API- I
125	*Citrullus colocynthis* Schard. Syn. *Cucumis colocynthis* L.	Hanzal	Root	UPI-II
126	*Citrullus colocynthis* Schrad	Hanzal	Root	UPI-IV
		Indravaruni	Root	API- II
127	*Clerodendrum phlomidis* L.	Agnimantha	Root	API- III
		Baharangi	Root	UPI-VI
128	*Clerodendrum serratum* (L.) Moon	Bharangi	Root	API- III
		Cirutekku	Root	SPI-II
129	*Clitoria ternatea* L.	Aparajita	Root	API- II
		Kakkana ver	Root	SPI-I
130	*Coccinia indica* W. & A.	Bimbi	Whole plant	API- III
131	*Cochlearia armoracia* Linn.	Cochlearia armoracia	Root	HPI-III
132	*Coix lacryma jobi* L.	Gavedhuka	Root	API- V
133	*Coldenia procumbens* L.	Tripaksi	Whole plant	API- VI
		Ceruppataic camulam	Whole plant	SPI-II
134	*Coleus forskohlii* Briq.syn. *Coleus barbatus* Benth.	Gandira	Root	API- V
		Coleus, Coleus forkskonlii	Whole or cut dried root	IP 2007, IP 2010, IP 2014
135	*Collinsonia Canadensis* Linn.	Collinsonia canadensis	Rhizome	HPI-II & VIII
136	*Conium maculatum* Linn.	Conicum maculatum	Whole plant	HPI-I
137	*Convallaria majalis* Linn.	Convallaria majalis	Whole plant	HPI-II
138	*Convolvulus pluricaulis* Choisy	Sankhapuspi	Whole plant	API- II
139	*Corallocarpus epigaeus* Benth ex Hook.f.	Akacakarutan kilanku	Tuber root	SPI-II
		Sukanasa	Rhizome	API- VI
140	*Coscinium fenestratum* (Gaertn.) Colebr.	Kaliyaka	Root	API- V
141	*Costus speciosus* (J.Koenig) Sm.	Kebuka	Rhizome	API- V
142	*Cryptolepis buchanani* Roem. & Schult.	Krsnasariva	Root	API- IV
143	*Cuphea viscosissima* Jacq.	Cuphea viscosissima	Whole plant	HPI-IX
144	*Curculigo orchioides* Gaertn.	Talamuli	Rhizome	API- IV
		Nilap panaik kilanku	Tuberous root	SPI-II
145	*Curcuma amada* Roxb	Amba Haldi	Rhizome	UPI-V
		Amra-haridra	Rhizome	API- V
146	*Curcuma longa* L.	Haridra	Rhizome	API- I
		Mancal	Rhizome	SPI-I
		Haridra Haldi; Turmeric; Curcuma longa	Dried rhizomes	IP 2007, IP 2010, IP 2014
		Zard Chob	Dried rhizomes	UPI-I
		Curcuma longa	Rhizome	HPI-V

147	*Curcuma zedoaria* Rosc.	Karcura	Rhizome	API- IV
		Kiccalik kilanku	Rhizome	SPI-II
148	*Cuscuta reflexa* Roxb.	Aftimoon	Whole plant	UPI-III
149	*Cyclamen europaeum* Linn.	Cyclamen europeaum	Root	HPI-IV
150	*Cymbopogon citratus* (DC) Stapf.	Kattrna	Whole plant	API- V
151	*Cymbopogon martinii* (Roxb.) Wats	Rohisa	Whole plant	API- V
		Izkhar	Whole plant	UPI-V
152	*Cynara scolymus* Linn.	Cynara scolymus	Whole plant	HPI-IX
153	*Cynodon dactylon* (L.) Pers.	Durva	Root	API- III
		Doob	Root	UPI-IV
		Durva	Whole plant	API- IV
		Cynodon dactylon	Whole plant	HPI-II
154	*Cyperus rotundus* L.	Musta	Rhizome	API- III
		Saad Kufi	Rhizome	UPI-V
155	*Cypripedium pubescene* Willd.	Cypripedium pubesceus	Rhizome	HPI-V
156	*Datura metel* L.	Dhattura	Whole plant	API- IV
157	*Datura stramonium* Linn.	Stramonium	Whole plant	HPI-II
158	*Daucus carota* L.	Gazar	Root	UPI-II
159	*Delphinium denudatum* Wall.	Jadwar	Root	UPI-VI
160	*Dendrophthoe falcata* (L.f.) Ettingshsh syn. *Loranthus longiflorus* Desr.	Vanda	Aerial root	API- V
161	*Derris ferruginea* Benth	Derris	Dried rhizome and root	IPL, IP 55
162	*Desmodium gangeticum* DC	Salaparni	Root	API- III
		Desmodium gangeticum	Root	HPI-VI
		Salaparni	Whole plant	API- VI
163	*Desmostachya bipinnata* Stapf	Kusa	Root stock	API- III
164	Dioscorea bulbifera L.	Varahi	Rhizome	API- IV
165	*Dioscorea villosa* Linn.	Dioscorea villosa	Rhizome	HPI-I
166	*Doronicum hookeri* C.B.Clarke	Vrscikakanda	Rhizome	API- VI
167	*Draba verna* Linn.	Draba verna	Whole plant	HPI-IX
168	*Drosera rotundifolia* Linn.	Drosera rotundifolia	Whole plant	HPI-I & IX
169	*Dryopteris filix-mas* (L.) Schott	Sphitakitari	Rhizome	API- VI
170	*Dryopteris odontoloma* (Moore) C.Chr.	Filix mas, Male fern	Rhizome	IP 55, IP 66
171	*Drypteris filix-mas* (Linn.) Schott.	Filix mas	Rhizome	HPI-II
172	Echinacea purpurea (Linn.) Moench.	Echinacea purpurea	Whole plant	HPI-IX

173	*Echinocactus williamsii* Lem.	Anahalonium lewini	Whole plant	HPI-VI
174	*Eclipta alba* (L.) Hassk.	Bhrngaraja	Whole plant	API- II
		Eclipta alba	Whole plant	HPI-IX
		Bhangra	Whole plant	UPI-IV
175	*Eclipta prostrate* L.	Karicalankannic camulam	Whole plant	SPI-II
176	*Eichhornia crassipes* (Mart.) Solms.	Eichhornia crassipes	Whole plant	HPI-VIII
177	*Eleusine coracana* Gaertn.	Madhulika	Root	API- V
178	*Enchinacea angustifolia* DC.	Enchinacea angustifolia	Whole plant	HPI-I
179	*Enicostemma axillare* (Lam.) A. Raynal	Nahi	Whole plant	API- VI
		Vellarukuc camulam	Whole plant	SPI-II
180	*Epiphagus virginiana* (Linn.) Bart.	Epiphagus virginiana	Whole plant	HPI-V
181	*Equisetum hyemale* Linn.	Equisetum hvemale	Whole plant	HPI-II
182	*Erechthites hieracifolia* Linn.	Erechthites	Whole plant	HPI-VI
183	*Erigeron canadensis* Linn.	Erigeron canadense	Whole plant	HPI-IV
184	*Erodium cicutarium* (L.) L'Her.	Erodium cicuarium	Whole plant	HPI-VIII
185	*Eryngium aquaticum* Linn.	Eryngium aquaticum	Root	HPI-IV
186	*Eschscholtzia californica* Charm.	Eschscholtzia californica	Whole plant	HPI-VIII
187	*Eupatorium aromaticum* Linn.	Eupatorum aromaticum	Root	HPI-VII
188	*Eupatorium purpureum* Linn.	Eupatorium purpurium	Root	HPI-IV
189	*Euphorbia corllata* Linn.	Euphorbia corolleta	Root	HPI-V
190	*Euphorbia cyparissias* Linn.	Euphorbia cyparissias	Whole plant	HPI-VIII
191	*Euphorbia dracunculoides*(Lam)	Saptala	Whole plant	API- II
192	*Euphorbia hirta* L.	Brhatdugdhika	Whole plant	API- VI
193	*Euphorbia prostrata* W. Ait.	Doodhi khurd	Whole plant	UPI-V
194	*Euphorbia thymifolia* L.	Dugdhika	Whole plant	API- V
195	*Euphrasia officinalis* Linn.	Euphrasia officinalis	Whole plant	HPI-I
196	*Exogonium purga* (Wenderoth) Benth.	Jalapa	Root	HPI-II
197	*Fagonia cretica* L.	Dhanvayasah	Whole plant	API- V
		Shukai	Whole plant	UPI-V
198	*Fagopyrum esculentum* Moench.	Fagopyrum esculentum	Whole plant	HPI-IV, VII
199	*Ferula sumbul* Hook. f.	Sumbul	Root	HPI-II
200	*Ficus arnottiana* Miq.	Nandi	Root	API- V
201	*Ficus bengalensis* Linn.	Reesh-e-Bargad	Aerial root	UPI-VI
		Ficus indica	Aerial root	HPI-VI
		Nayagrodha Jata	Aerial root	API- IV

202	*Ficus hispida* L.	Kath Gular	Root	UPI-IV
		Phalgu	Root	API- III
203	*Fucus vesiculosus* Linn.	Fucus vesiculosus	Whole plant	HPI-III,IX
204	*Fumaria parviflora* Lam.	Parpata	Whole plant	API- IV
		Shahtara	Whole plant	UPI-VI
205	*Galega officinalis* Linn.	Galega officinalis	Whole plant	HPI-VIII
206	*Gelsemium sempervirens* (Linn.) Ait F.	Gelsemium semperviens	Rhizome	HPI-I
207	*Genista tinctoria* Linn.	Gentiana cruciata	Whole plant	HPI-V
208	*Gentiana cruciata* Linn.	Genista tinctoria	Root	HPI-VII
209	*Gentiana kurroo* Royle.	Trayamana	Rhizome	API- VI
210	*Gentiana lutea* Linn.	Gentians lutea	Rhizome	HPI-III
211	*Glinus lotoides* L.	Usandi	Whole plant	API- VI
		Ciruceruppataic camulam	Whole plant	SPI-II
212	*Gloriosa superba* L.	Langali	Tuberous root	API- III
213	*Glycosmis pentaphylla* Correa.	Atista radix	Root	HPI-VI
214	*Glycyrrhiza glabra* L.	Asl-us-Soos	Dried root	UPI-I
		Yasti	Stolen andRoot	API- I
		Atimaturam	Stolen and Root	SPI-I
215	*Gmelina arborea* Roxb.	Gambhari	Root bark	API- I
216	*Gnaphalium polycephalum* Michx.	Gnaphalium polycephalum	Whole plant	HPI-IV
217	*Gossypium herbaceum* Linn.	Gossypium herbaceum	Inner bark of root	HPI-II
218	*Gratiola officinalis* Linn.	Gratiola officinalis	Whole plant	HPI-V
219	*Gymnema sylvestre* R. Br.	Ciru kuruncan ver	Root	SPI-I
		Mesasrngi	Root	API- V
		Gurmar	Root	UPI-V
220	*Hedychium spicatum* Ham. ex Smith	Sati	Rhizome	API- I
		Shati, Hedychium spicatun	Dried rhizomes	IP 2007, IP 2010, IP 2014
221	*Helianthemum canadense* Mich.	Cistus canadensis	Whole plant	HPI-IV
222	*Helleborus niger* Linn.	Helleborus niger	Rhizome	HPI-I
223	*Hemidesmus indicus* (L.) R. Br.	Nannari	Root	SPI-I
		Anantmula, Sariva, Indian Sarsaparilla	Dried root	IP 2010, IP 2014
		Hemidesmus, Anantamul	Dried root	IP 55
		Hemidesmus indicus	Root	HPI-VIII
		Sveta Sariva	Root	API- I

224	*Heracleum sphondylim* Linn.	Branca ursina	Whole plant	HPI-V
225	*Herniaria glabra* Linn.	Hernlniria glabra	Whole plant	HPI-VIII
226	*Hibiscus sabdariffa* L.	Ambasthaki	Root	API- III
227	*Hordeum vulgare* L.	Yava	Whole plant	API- IV
228	*Hydrangea arborescens* Linn.	Hydrangea arborescens	Rhizome	HPI-III
229	*Hydrastis canadensis* Linn.	Hydrastis canadensis	Rhizome	HPI-I, IX
230	*Hyoscyamus niger* Linn.	Hyoscyamus niger	Whole plant	HPI-I
231	*Hypericum perforatum* Linn.	Hypericum perforatum	Whole plant	HPI-I, VIII
232	*Imperata cylindrica* (L.) Beauv	Darbha	Root	API- V
233	*Indigofera aspalathoides* Vahl ex DC.	Siva-Nili	Root	API- VI
234	*Indigofera tinctoria* L.	Nili	Root	API- II
		Avuri ver	Root	SPI-I
		Nili	Whole plant	API- III
		Avuri	Whole plant	SPI-I
235	*Inula helenium* Linn.	Inula	Rhizome	HPI-III
236	*Inula racemosa* Hook.f.	Puskara	Root	API- IV
237	*Ipomoea digitata* L.	Kshiravidari	Root	API- V
		Badari kand	Root	UPI-V
238	*Ipomoea orizabesis* (Pelletan) Ledanois.	Ipomoea	Dried root	IPL, IP 55
239	*Ipomoea turpenthum* R.Br.	Yurpethum, Yurpeth	Dried root	IPL
240	*Iris ensata* Thunb.	Irsa	Root	UPI-II
241	*Iris germanica* Linn.	Iris germanica	Rhizome	HPI-IX
242	*Iris verslcolor* Linn.	Iris versicolor	Rhizome	HPI-II
243	*Juglans cinerea* Linn.	Juglans cinerea	Inner bark root	HPI-IV
244	*Juncus effusus* Linn.	Juncus effusus	Rhizome	HPI-V, IX
245	*Juniperus communis* L.	Hapusa	Fresh root	API- III
246	*Justicia adhatoda* L.	Atatotai ver	Root	SPI-I
247	*Krameria triandra* Ruiz et. Pavon.	Ratanhia	Root	HPI-II
248	*Lachnanthes tinctoria* Ell.	Lachinanthes tinctoria	Whole plant	HPI-IV
249	*Lactuca virosa* Linn.	Lactuca	Whole plant	HPI-VII
250	*Ledum palustre* Linn.	Ledum palustre	Whole plant	HPI-I
251	*Lemna minor* Linn.	Lemna minor	Whole plant	HPI-IV
252	*Leonotis nepetaefolia* R.Br.	Granthiparni	Root	API- III
253	*Leonuorus cardiaca* Linn.	Leonorus cardiaca	Whole plant	HPI-VIII
254	*Leptadenia reticulata* W.& A.	Jivanti	Root	API- VI
255	*Lespedeza cafitata*Michx.	Lespedeza cafitata	Whole plant	HPI-IX
256	*Leucas aspera* Sprang.	Leucas aspera	Whole plant	HPI-VI, VIII
257	*Leucas cephalotes* Spreng.	Dronapuspi	Whole plant	API- II
258	*Levisticum officinale* Koch.	Levisticum officinale	Rhizome	HPI-VIII

259	*Lilium polyphyllum* D.Don	Kakoli	Tuber root	API- III
260	*Lillium tigrinum* Ker-Gawl.	Lilium tigrinum	Whole plant	HPI-V, IX
260	*Linaria vulgaris* Mill.	Linaria vulgaris	Whole plant	HPI-VI
262	*Lobaria pulmonaria* (Linn.) Haffm.	Sticta pulmonaria	Whole plant	HPI-IV
263	*Lobelia cardinalis* Linn.	Lobelia cardinalis	Whole plant	HPI-V
264	*Lobelia syphilitica* Linn.	Lobelia syphilitica	Whole plant	HPI-VI
265	*Loeselia coccinea* G. Don	Hoitzia coccinea	Whole plant	HPI-VIII
266	*Luffa acutangula* (L.) Roxb.	Kosataki	Whole plant	API- III
267	*Luffa echinata* Roxb.	Luffa bindal	Whole plant	HPI-VI
268	*Lycopersicum esculentum* Milli.	Lycopersicum esculentum	Whole plant	HPI-V
269	*Lycopus virginicus* Linn.	Lycopus virgnicus	Whole plant	HPI-IV
270	*Mandragora officinarum* Linn.	Mandragora officinarum	Root	HPI-VII
271	*Maranta arundinacea* L.	Ararota	Rhizome	API- VI
272	*Marsdenia tenacissima* Wight. & Arn.	Murva	Root	API- II
273	*Mentha spicata* Linn.	Mentha viridis	Whole plant	HPI-IX
274	*Menyanthes trifoliate* Linn.	Menvanthes trifoliata	Whole plant	HPI-II, VIII
275	*Mercurialis perennis* Linn.	Mercurialis perennis	Whole plant	HPI-IV, VII
276	*Merremia tridentata* (L.)Hall.f.	Matsyapatrika	Whole plant	API- VI
277	*Mimosa pudica* L.	Lajjalu	Whole plant	API- II
		Mimosa pudica	Root	HPI-IX
278	*Mitchella repens* Linn.	Mitchella repens	Whole plant	HPI-VI
279	*Mollugo cerviana* Seringe	Parpatakam	Whole plant	SPI-II
		Grismachatraka	Whole plant	API- VI
280	*Momordica dioica* Roxb ex willd	Karkasa	Root	API- V
281	*Monochoria vaginalis* Presl	Indivara	Rhizome	API- VI
		Cenkalunirk kilanku	Rhizome	SPI-II
282	*Moringa oleifera* Lam.	Sigru	Root bark	API- IV
		Moringa oleifera	Whole plant	HPI-IX
283	*Mucuna prurita* Hook.	Atmagupta	Root	API- IV
284	*Musa paradisiaca* L.	Kadali	Fresh rhizome	API- III
		Kela	Rhizome	UPI-IV
		Valaik kilanku	Rhizome	SPI-II
285	*Myrica certifera* Linn.	Myrica cerifera	Root bark	HPI-I
286	*Narcissus pseudo narcissus* Linn.	Narcissus pseudo narcissus	Whole plant	HPI-VI
287	*Nardostachys grandiflora* DC.	Cata mancil	Rhizome	SPI-I
288	*Nardostachys jatamansi* DC	Sumbul-ut-Teeb	Dried rhizome	UPI-I
		Jatamansi	Dried rhizome	IP 66
		Jatamansi	Rhizome	API- I

289	*Nelumbo nucifera* Gaertn.	Kamala	Rhizome	API- III
		Tamaraik kilanku	Rhizome	SPI-I
290	*Nerium indicum* Mill.	Karavira	Root	API- III
		Dafli/Dafla	Root	UPI-IV
291	*Nuphar luteum* Sibth and Smith.	Nuphar lutea	Rhizome	HPI-VI
292	*Nymphaea odorata* Soland	Nymphea odorata	Root	HPI-V
293	*Ocimum gratissimum* Linn.	Ocimum gratissimum	Whole plant	HPI-VI
294	*Ocimum sanctum* L.	Tulasi	Whole plant	API- II
		Rehan	Whole plant	UPI-V
295	*Oenanthe crocata* Linn.	Oentanthus crocata	Root	HPI-V
296	*Oldenlandia corymbusa* Linn.	Oldenlandia herbacea	Whole plant	HPI-VII
297	*Ononis spinosa* Linn.	Ononis spinosa	Root	HPI-VIII
298	*Onosma hispidum* wall. ex. D. Don. Syn. *O. echioides* C.B. Clarke non L.	Ratanjot	Dried root	UPI-III
299	*Onosmodium virginianum* (L.) A.D.C.	Onosmodium virginianum	Root	HPI-VII
300	*Operculina turpethum* (L.) Silva Manso	Trivrit	Root	API- III
		Turbud	Root	UPI-V
301	*Orchis latifolia* Linn.	Salab Misri	Tuberous root	UPI-VI
302	*Orchis mascula* L.	Salab Misri	Dried Root tubers	UPI-III
303	*Origanum vulgare* Linn.	Origanum vulgare	Whole plant	HPI-VII
304	*Ornithogalum umbellatum* Linn.	Ornithogalum umbellatum	Whole plant	HPI-IX
305	*Oroxylum indicum* vent.	Syonaka	Root	API- III
306	*Oryza sativa* L.	Sali	Root	API- II
307	*Oxalis corniculata* L.	Cangeri	Whole plant	API- III
		Puliyarai	Whole plant	SPI-II
308	*Paederia foetida* L.	Prasarini	Whole plant	API- II
309	*Paeonia emodi* Wall.	Ood-e-Saleeb	Dried root tubers	UPI-III
310	*Paeonia officianalis* Linn.	Paeonia officinalis	Root	HPI-IV
311	*Panax quinquefolium* Linn.	Ginseng	Root	HPI-III
312	*Pandanus odoratissimus* Roxb.	Ketaki	Stilt root	API- VI
		Talai vilutu	Stilt root	SPI-II
313	*Pandanus tectorius* Soland ex Parkinson	Ketaki	Root	API- I
314	*Paris quadrifolia* Linn.	Paris quadrifolia	Whole plant	HPI-IV
315	*Paronychia illecebroides* Webb.	Paronichia illecebrum	Whole plant	HPI-VIII
316	*Parthenium hysterophorous* Linn.	Parthenium	Whole plant	HPI-VII

317	*Pastinaca sativa* Linn.	Pastinaca	Root	HPI-V
318	*Pastinaca secacul* Linn.	Shaqaqul-Misri	Dried rhizome	UPI-III
319	*Paullinia pinnata* Linn.	Paullinia pinnata	Root	HPI-V
320	*Pavetta indica* L. Var *tomentosa* Hook.	Papatah	Root	API- VI
321	*Pavonia odorata* Willd.	Gandhasipha	Whole plant	API- VI
322	*Penthorum sedoides* Linn.	Penthorum sedoides	Whole plant	HPI-VII
323	*Pergularia daemia* (Forsk) Chiov.	Visanika	Whole plant	API- VI
324	*Peristrophe bicalyculata* (Retz.) Nees	Kakajangha	Root	API- III
325	*Petasites fragrans* Presl.	Tussilago fragrans	Whole plant	HPI-VI
326	*Petasites japonicus* F. Schm.	Tussiilago petasites	Whole plant	HPI-V
327	*Peteroselinum cripsum* (Mill) Mym.	Petroselinum sativum	Whole plant	HPI-IV
328	*Phyla nodiflora* (L.) Greene	Jalapippali	Whole plant	API- V
		Potutalai	Whole plant	SPI-I
329	*Phyllanthus amarus* Schum. & Thonn.	Kilkkai nellic camulam	Whole plant	SPI-I
330	*Phyllanthus fraternus* Webst.	Tamalaki	Root	API- I
331	*Phytolacca americana* Linn.	Phytolacca	Root	HPI-I
332	*Picrorhiza kurroa* Royle ex Benth.	Kutki Picrorhiza kurroa	Dried root	IP 2007, IP 2010, IP 2014
		Katuka	Rhizome	API- II
		Kutki	Rhizome	UPI-IV
		Katuku rokini	Root	SPI-I
		Picrorhiza	Dried rhizome	IPL, IP 55, IP 66
333	*Pimpinella saxifraga* Linn.	Pimpinella saxifraga	Fresh root	HPI-VII
334	*Pinus roxburghii* Sargent	Sanobar	Root	UPI-V
		Sarala	Root	API- III
335	*Piper methysticum* Forst.	Piper methysticm	Rhizome	HPI-III
336	*Piscidia erythrina* Linn.	Piscidia	Root bark	HPI-III
337	*Pistia stratiotes* L.	Jalakumbhi	Whole plant	API- VI
338	*Plantago major* Linn.	Plantago major	Whole plant	HPI-II
339	*Plumbago indica* L.	Rakta Citraka	Root	API- VI
340	*Plumbago zeylanica* L.	Citrakah	Root	API- I
341	*Podophyllum hoxandrum* Royle	Podophyllum	Dried rhizome and root	IP 55
342	*Podophyllum peltatum* Linn.	Podophyllum peltatum	Rhizome	HPI-I
343	*Polygala chinensis* L.	Chinensis	Dried root	IPL, IP 55
344	*Polygala senega* Linn.	Senega	Root	HPI-I
345	*Polygonatum cirrhifolium* Royle	Meda	Rhizome	API- VI
		Mahameda	Root and Rhizome	API- V

346	*Polygonum bistorta* L. Syn. *P. paleaceum* Wall. ex Hook f.	Anjabar	Dried rhizome	UPI-III
347	*Polygonum punctatum* Ell.	Polygonum punetatum	Whole plant	HPI-IV
348	*Polypodium vulgare* L.	Bisfayej	Rhizome	UPI-II
349	*Pongamia pinnata* L. Pierre.	Punkan verpattai	Root bark	SPI-I
		Karanj	Root	UPI-IV
		Karanj	Root bark	UPI-IV
		Karanja	Root	API- II
		Karanja	Root bark	API- II
350	*Portulaca oleracea* L.	Kozuppa	Whole plant	API- II
		Khurfa	Whole plant	UPI-IV
351	*Potentilla erecta* (Linn.) Rauschel.	Potentilla erecta	Root	HPI-VIII
352	*Pothos foetidus* Mich.	Pothos foetidus	Root	HPI-IV
353	*Prenanthes serpentaria* Pursh.	Nabalus serpentaria	Whole plant	HPI-VII
354	*Prunus avium* L.	Elavalukam	Root	API- VI
355	*Pueraria tuberosa* DC.	Vidari	Tuber root	API- II
356	*Pulsatilla nigricans* Linn.	Pulsatilla nigricans	Whole plant	HPI-I
357	*Punica granatum* Linn.	Granatum	Root bark	HPI-III
358	*Ramunculus repens* Linn.	Ranunculus repens	Whole plant	HPI-VIII
359	*Ranunculos bulbosus* Linn.	Ranunculus bulbosus	Whole plant	HPI-IV, VIII
360	*Ranunculus acris* Linn.	Ranunculus acris	Whole plant	HPI-V
361	*Raphanus sativus* L.	Turb	Root	UPI-V
		Mulaka	Root	API- II
		Mulaka	Whole plant	API- II
		Raphanus sativus	Root	HPI-V
362	*Rauvolfia serpentina* Benth. ex Kurze.	Rauvolfia serpentina	Root	HPI-I
		Rauwolfia	Dried root	IPL, IP 55, IP 66
		Sarpagandha Powder, Rauwolfia serpentina Powder	Dried root	IP 2010, IP 2014
		Sarpagandha Tablet, Rauwolfia serpentina Tablet	Dried root	IP 2010, IP 2014
		Sarpagandha, Rauwolfia serpentina Root	Dried root	IP 2007, IP 2010, IP 2014
		Sarpagandha	Root	API- V
		Asrol	Root	UPI-V
363	*Rheum emodi* Wall	Rheum, Rhubark	Dried rhizome and root	IPL, IP 55, IP 66
		Rewandchini	Root	UPI-II

364	*Rheum officinale* Baillon	Rheum	Rhizome	HPI-II
365	*Ricinus communis* Linn.	Eranda	Root	API- I
366	*Robinia pseudocacia* Linn.	Robinia pseudocacia	Bark of root	HPI-V
367	*Rumex crispus* Linn.	Rumex crispus	Rhizome	HPI-II
368	*Ruta graveolens* Linn.	Ruta graveolens	Whole plant	HPI-I
369	*Saccharum bengalense* Retz.	Sara	Root	API- III
370	*Saccharum officinarum* L.	Iksu	Root stock	API- IV
371	*Saccharum spontaneum* L.	Kasa	Root stock	API- III
372	*Salvadora persica* L.	Pilu	Root bark	API- V
		Pilu	Root bark	UPI-V
373	*Salvia haematodes* L.	Behman Surkh	Dried root	UPI-III
374	*Sanguinaria canadenisis* Linn.	Sanguinaria canadenisis	Rhizome	HPI-I
375	*Santolina chamaecyparissus* Linn.	Santolina chamaecyparissus	Whole plant	HPI-IX
376	*Saponaria officinalis* Linn.	Saponaria officinalis	Root	HPI-VI, VII, VIII
377	*Sarracenia purpurea* Linn.	Sarracenia purpurea	Whole plant	HPI-IV
378	*Saussurea costus* (Falc.) Lipsch.	Kottam	Root	SPI-I
379	*Saussurea lappa* C.B. Clarke	Qust	Dried root	UPI-I
		Kustha	Root	API- I
		Saussurea	Dried root	IPL, IP 55, IP 66
380	*Scirpus kysoor* Roxb.	Kaseru	Rhizome	API- I
381	*Scrophularia nodosa* Linn.	Scrophularia nodosa	Whole plant	HPI-VI
382	*Sedum acre* Linn.	Sedum acre	Whole plant	HPI-VI
383	*Selinum candollei* DC.	Mura	Root	API- II
384	*Selinum vaginatum* C.B. Clarke	Bhutakesi	Rhizome	API- VI
385	*Senecio aureus* Linn.	Senecio aureus	Whole plant	HPI-II
386	*Senecio cineraria* DC.	Cineraria maritima	Whole plant	HPI-V
387	*Sesbania bispinosa*W.F.Wight	Itkata	Root	API- V
388	*Sida acuta* Burm, f.& *ssp. acuta*	Bala, Sida acuta	Dried root	IP 2014
389	*Sida rhombifolia* L.	Mahabala	Root	API- III
390	*Siegesbeckia orientalis* Linn.	Siegesbeckia orientalis	Whole plant	HPI-IX
391	*Silphium laciniatum* Linn.	Silphinum laciniatum	Whole plant	HPI-VI
392	*Smilax aristolochiaefolia* Mill.	Ushba	Root	UPI-VI
393	*Smilax china* L.	Madhusnuhi	Tuber root	API- V
		Parankic cakkai	Tuber root	SPI-I
		Chob chini	Tuberous root	UPI-V
394	*Smilax ornata* Hook. f.	Sarsaparilla	Rhizome	HPI-III

395	*Solanum anguivi* Lam.	Brhati	Whole plant	API- VI
396	*Solanum carolinense* Linn.	Solanum carolinense	Whole plant	HPI-V
397	*Solanum dulcamara* Linn.	Dulcamara	Whole plant	HPI-I
398	*Solanum indicum* L.	Brhati	Root	API- II
		Kakamaci	Whole plant	API- II
		Mako	Whole plant	UPI-IV
		Solanum nigrum	Whole plant	HPI-II
399	*Solanum surattense* Burm.f.	Kantakari	Whole plant	API- I
		Kantan kattiric camulam	Whole plant	SPI-I
		Solanum xanthocarpum	Whole plant	HPI-VI
400	*Sphaeranthus indicus* Linn.	Munditika	Whole plant	API- IV
401	*Spigelia marllandica* Linn.	Sparteinum sulphuricum	Whole plant	HPI-VI
402	*Stellaria media* (Linn.) Vill.	Stellaria media	Whole plant	HPI-IX
403	*Stereospermum chelonoides* (L.f.) DC.	Patiri ver	Root	SPI-I
404	*Stereospermum suaveolens* DC.	Patala	Root	API- III
405	*Stillinga sylvatica* Linn.	Stillingia sylvatica	Root	HPI-III
406	*Swertia chirata Buch.* Ham.	Kiratatikta	Whole plant	API- I
407	*Symphytum officianle* Linn.	Symphytum officinale	Root	HPI-III
408	*Tamus communis* Linn.	Tamrus communis	Root	HPI-V
409	*Taraxacum officinale* Weber	Taraxacum	Whole plant	HPI-III
410	*Teramnus labialis* Spreng.	Masaparni	Whole plant	API- III
411	*Teucrium marum* Linn.	Teucrum marum verum	Whole plant	HPI-IV
412	*Thymus serphyllum* Linn.	Thymus serpyllum	Whole plant	HPI-VII
413	*Thymus vulgaris* Linn.	Thymus vulgaris	Whole plant	HPI-VIII
414	*Toddalia asiatica* (L.) Lam.	Katugulma	Whole plant	API- VI
415	*Tragia involucrata* L.	Vrscikalli	Whole plant	API- IV
416	*Trianthema decandra* L.	Laghupatra-Varsabhu	Whole plant	API- VI
417	*Trianthema portulacastrum* Linn.	Varsabhu	Root	API- IV
418	*Tribulus terrertris* L.	Neruncil camulam	Whole plant	SPI-II
		Goksura	Root	API- I
		Nerunci ver	Root	SPI-I
		Goksura	Whole plant	API- VI
		Tribulus terrestris	Whole plant	HPI-I
419	*Trichosanthes bracteata* (Lam.) Voigt	Visala	Root	API- V
420	*Trichosanthes dioica* Robx.	Trichosanthe dioica	Root	HPI-VI
421	Triosteum *perfoliatum* Linn.	Trosteum perfoliatum	Root	HPI-VII

422	*Turnera diffusa* Willd var. *aphrodisiaca* Vrb.	Damiana	Whole plant	HPI-V & VII
423	*Tussilago farfara* Linn.	Tussilago farfara	Whole plant	HPI-IV
424	*Typha australis* Schum. & Thonn.	Gundrah	Root & rhizome	API- V
425	*Typha elephantina* Roxb.	Potagala	Root	API- V
426	*Typha latifolia* Linn.	Typha latifolia	Root stock	HPI-IX
427	*Uraria picta* Desv.	Prsniparni	Whole plant	API- IV
428	*Urticaurens* Linn.	Urtica urens	Whole plant	HPI-IV
429	*Usnea barbata* Heffm.	Usnea barbata	Whole plant	HPI-V
430	*Valeriana officinalis* Linn.	Valerians officinalis	Rhizome	HPI-II
431	*Valeriana wallichii* DC	Tagar	Dried rhizome, stolon & small portion of root	UPI-I
		Tagara	Rhizome	API- I
432	*Vallaris solanacea* Kuntze	Asphota	Root	API- V
433	*Veratrum album* Linn.	Veratrum album	Rhizome	HPI-II
434	*Veratrum virde* Ait.	Veratrum viride	Rhizome	HPI-I
435	*Verbascum thapsus* Linn.	Verbascum thaspus	Whole plant	HPI-II
436	*Verbena officinalis* Linn.	Verbena officinalis	Whole plant	HPI-VI
437	*Vernonia cinerea* Lees.	Sahadevi	Whole plant	API- III
438	*Veronicastrum virginicum* (L.) Farwell.	Leptandra	Rhizome	HPI-III, VII
439	*Vetiveria zizaniodes* (L.) Nash	Vetti ver	Root	SPI-II
		Usira	Root	API- III
		Khas	Root	UPI-IV
440	*Vigna trilobata* (L.) Verdc.	Mudgaparni	Whole plant	API- IV
441	*Vinca minor* Linn.	Vinca minor	Whole plant	HPI-IV
442	*Viola odorata* Linn.	Viola odroata	Whole plant	HPI-IV
443	*Viola tricolor* Linn.	Viola tricolor	Whole plant	HPI-IV
444	*Vitex negundo* L.	Nirgundi	Root	API- IV
445	*Wedelia calendulacea* Lees.	Kesaraja	Whole plant	API- VI
446	*Withania somnifera* (L.) Dunal.	Amukkara	Root	SPI-I
		Withania radix, Aswagandha	Dried root	IP 55, IP 66
		Asvagandha	Root	API- I
		Asgand	Dried root	UPI-I
		Withania somnifera	Root	HPI-I, VIII
447	*Wyethia helenioides* Nuttl.	Wyethia helenioides	Root	HPI-VI
448	*Xanthium spinosum* Linn.	Xanthium sfinosum	Whole plant	HPI-IX
449	*Yucca filamentosa* Linn.	Yucea filamentosa	Root	HPI-V

450	*Zingiber officinale* Rosc.	Cukku	Dried rhizome	SPI-I
		Zanjabeel	Dried rhizome	UPI-I
		Inci	Fresh rhizome	SPI-I
		Ardraka	Rhizome	API- II
		Adrak	Rhizome	UPI-IV
		Zingiber	Dried rhizome	HPI-II
		Sunthi Saunth; Ginger; Zingiber officinale	Whole or cut scraped or unscraped, Dried rhizomes	IP 2007, IP 2010, IP 2014
		Sunthi	Rhizome	API- I
		Ginger, Zingiber	Rhizome- scraped to remove the dark outer skin and dried in sun.	IP 55, IP 66

2. Monographic Review –The publishedIndian literature in the form of books, monographs etc. werereviewed. The work pertinent to pharmacognostical characteristics of root and rhizome drugs is enumerated in Table-2.

Table 2: Pharacognostic work on Root and Rhizome drugs in monographic and book references

Sl. No	Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
1	*Abelmoschus moschatus* Medic.	Mushkdana	Root	SSDUM-V
2	*Abroma augusta Linn*.	Abroma	Root	PIRRD
		Peevari	Root	PID-II
		Piscakarpasa	Root	QSIMP-X
3	*Abrus precatorius* Linn.	Abrus	Root	PIRRD
		Gunja	Root	PAD-I
		Gunja	Root	PID-III
		Gunja	Root	QSIMP-VIII
4	*Abutilon indicum* G. Don.	Bala	Root	PAD-V
		Atibala	Root	QSIMP- I
5	*Acalypha fruticosa* Forssk.	Laghu haritmanjasi	Root	QSIMP-XIV
6	*Acalypha indica* Linn.	Acalypha	Root	PIRRD
		Haritamanjari	Whole plant	QSIMP-XII
7	*Achyranthes aspera* Linn.	Khar-e-vasgona	Root	SSDUM-IV
		Apamarga	Whole plant	PAD-VI

8	*Achyranthes aspera* Linn. *syn. A. canescens* R. Br.; *A. argentea* Decne; *A. grandifolia* Moq.; *A. obovata* Peter.; *A. repens* Linn.	Apamarga	Whole plant	QSIMP-IX
		Apang	Whole plant	IHP
9	*Achyranthes bidentata* Blume	Ceauradanada Apamarga	Whole plant	QSIMP-XI
10	*Aconitum balfourii* Stapf.	Aconite	Root	PIRRD
11	*Aconitum chasmanthum* Stapf. ex Holmes	Aconite	Root	PIRRD
		Vatsanabha	Tuberous root	QSIMP-X
12	*Aconitum heterophyllum* Wall. ex Royle	Atis	Dried Tuberous root	SSDUM-I
		Aconite	Root	PIRRD
		Atis	Root tuber	IHP
		Ativisa	Tuberous root	QSIMP-IV
13	*Aconitum laciniatum* Stapf.	Aconite	Root	PIRRD
14	*Aconitum napellus* Linn.	Aconite	Root	PIRRD
15	*Aconitum palmatum* D. Don..	Aconite	Root	PIRRD
16	*Aconitum spicatum* Stapf.	Aconite	Root	PIRRD
17	*Aconitum ferox* Wall. ex Ser.	Aconitum ferox	Tuberous root	QSIMP-XII
18	*Aconitum violaceum* Jacq. ex Stapf.	Aconitum violaceum	Tuberous root	QSIMP-XII
19	*Aconitum. deinorrhizum* Stapf.	Aconite	Root	PIRRD
20	*Acorus calamus* Linn.	Vacha	Rhizome	PID-III
		Acorus Calamus	Rhizome	SHD-I
		Vacha	Rhizome	PAD-III
		Calamus	Rhizome	PIRRD
		Vaca	Rhizome	QSIMP-X
21	*Adhatoda beddomei* C. B. Clarke.	Vasa	Root	PAD-VII
22	*Adhatoda vasica* Nees.	Vasa	Root	PAD-VII
23	*Adhatoda zeylanica* Medik. *syn. A. vasica* Nees	Vasa	Root	QSIMP-XIII
24	*Adiantum lunulatum Burm.* f. *syn. A. philippense* Linn.	Hamsapadi	Whole plant	QSIMP-XIV
25	*Adiantum capillus-veneris* Linn.	Bijapatra	Whole plant	QSIMP-XII
26	*Aegle marmelos* (L.) Corr.	Bel	Root	MPWG
		Vilva	Root bark	PAD-II
		Bilva	Root	QSIMP-XII
27	*Aerva lanata* (Linn.) Juss.	Bhadra	Whole plant	PAD-VI
		Pasanabheda	Whole plant	QSIMP- III

28	*Alectra parasitica* A. Rich. ssp. *chitrakutensis* (M. A. Rau) K. K. Khanna & A. Kumar	Nirgundi kanda	Rhizome	QSIMP-XIV
29	*Alhagi pseudalhagi* (M. Bieb.) Desv. syn. *A. camelorum* Fisch. ex DC.; *A. maurorum* sensu Baker, non Desv.	Yavasa	Whole plant	QSIMP-VII
30	*Aloe barbadensis* Mill.	Gheekawar	Root	SSDUM-V
31	*Alpinia calcarata* Rosc.	Rasna	Rhizome	PAD-XI
32	*Alpinia galanga* (Linn.) Willd. *syn. Amomum galanga* (Linn.) Lour.	Khulanjan	Rhizome	SSDUM-I
		Malayavaca	Rhizome	QSIMP- I
		Rasna	Rhizome	PAD-XI
33	*Alpinia officinarum* Hance. & A. galangal Sw.	Galanga	Root	PIRRD
34	*Alpinia calcarata* Rosc.	Granthi Mula	Rhizome	QSIMP-XII
35	*Alstonia scholaris* (L.) R.Br.	Kashim	Root	SSDUM-V
36	*Alternanthera sessilis* (Linn.) R.Br. ex DC. syn. *A. nodiflora* R. Br.	Matsyaksi	Whole plant	QSIMP-V
37	*Amaranthus tricolor* Linn. syn. *A. gangeticus* Linn.; *A. mangostanus* Linn.; *A. polygamous* sensu Hook. f. p.p., non Linn.; *A. tristis* Linn.	Ramsitalika	Whole plant	QSIMP-XII
38	*Anacyclus pyrethrum* DC.	Aqarqarha	Root	SSDUM-II
39	*Angelica archangelica* Linn. syn. *Archangelica officinalis* (Moench) Hoffm.; *A. officinalis* (Moench) Hoffm. var. *himalaica* Clarke	Canda	Root	QSIMP-XIII
40	*Angelica glauca* Edgew.	Choraka	Root	PID-I
		Nimba	Root	QSIMP-VIII
41	*Apama siliquosa* Lamk. syn. *Bragantia wallichii* R. Br. ex Wight & Arn. ; *Thottea siliquosa* (Lamk.) Ding Hou	Chakrani	Root	QSIMP-XIV
42	*Apium graveolens* Linn.	Kharaphsa	Whole plant	QSIMP-XIII
		Bekh-e-Karafs	Root	SSDUM-III
43	*Argemone mexicana* Linn.	Argemone mexicana	Root	PIRRD
		Swarnashiri	Root	PAD-XI
		Svarnaksiri	Whole plant	QSIMP-XII

44	*Argyreia nervosa* (Burm. f.) Bojer. syn. *A. speciosa* (Linn. f.) Sweet.	Vriddhadaruka	Root	PID-II
		Vrddhadaruka	Root	QSIMP-XI
		Vrddhadaraka	Root	PAD-VIII
45	*Aristolochia indica* Linn.	Aristolochia	Root	PIRRD
		Garudi	Root	PAD-VI
		Isavari	Root	QSIMP- II
46	*Aristolochia rotunda* Linn.	Zarawand Mudahraj	Root	SSDUM-II
47	*Armoracia rusticana* Gaertn.	Cochlearia Armoracia	Root	SHD-III
48	*Arnebia euchroma* (Royle) Johnston var. *euchroma* syn. *Macrotomia perennis* (Shrenk) Boiss.; *Lithospermum euchromum* Royle	Ratanjota	Root, Root stock	QSIMP- I
49	*Artemisia absinthium* Linn.	Bekh-e-Afsanteen	Root	SSDUM-II
50	*Artemisia annua* Linn.	Quinghaq (Chinese)	Whole plant	QSIMP- I
51	*Asclepias curassavica* Linn.	Kakanasa	Whole plant	QSIMP-VII
52	*Asparagus adscendens* Roxb.	Svetanusali	Root	QSIMP-IV
53	*Asparagus racemosus* Willd.	Asparagus	Root	PIRRD
		Satavari	Root	PAD-VI
		Satawar	Root	MPWG
		Satavara	Tuberous root	QSIMP- I
54	*Asteracantha longifolia* Nees.	Iksura	Root	PAD-VI
55	*Atropa acuminata Royle* ex Lindley.	Indica Belladonna	Root	PIRRD
56	*Azadirachta indica* A. Juss. syn. *Melia azadirachta* Linn.	Nimba	Root bark	QSIMP-XI
57	*Bacopa monnieri* (Linn.) Pennell syn. *Herpestis monnieria* (Linn.) H.B. & K.; *Lysimachia monnieri* Linn.	Brahmi	Root	MPWG
		Brahmi	Whole plant	QASIMP
		Brahmi	Root	PAD-XII
		Brahmi	Whole plant	IHP
		Priyala	Whole plant	QSIMP-VIII
58	*Baliospermum montanum* (Willd.) Muell. -Arg. syn. *Jatropha montana* Willd.; *Baliospermum axillare* Blume	Danti	Root	MPWG
		Nagadanti	Root	PAD-XI
		Danti	Root stock	PID-I
		Danti	Root	QSIMP-XIII
59	*Barleria prionitis* Linn.	Sairayak	Whole plant	QSIMP-IV
60	*Barringtonia acutangula* Gaertn.	Nicula	Root	PID-III
61	*Bergenia ciliata* (Haw.) Sternb. forma *ligulata* Yeo syn. *Saxifraga ligulata* Wall.; *B. ligulata* (Wall.) Engl.	Pasanbheda	Rhizome	QSIMP- I
		Dakachru	Rhizome	IHP

62	*Biophytum reinwardtii* Edgw. & Hk. f.	Lajjalu	Whole plant	PAD-VI
63	*Biophytum sensitivum* DC.	Lajjalu	Whole plant	PAD-VI
64	*Blumea lacera* (Burm. f.) DC. syn. *B. subcapitata* DC.	Kukundara	Root	PID-III
		Kumundara	Whole plant	QSIMP-VI
65	*Boerhavia diffusa* Linn. syn. *B. repens* Linn. var. *procumbens* Hook. f.; *B. procumbens* Banks ex Roxb.	Punarnava	Root	PAD-V
		Gadapurna	Whole plant	IHP
		Punarnava	Whole plant	QSIMP-IX
66	*Borrerio hispida* (Linn.) K. Schum	Vasuka	Root	PAD-XII
67	*Caesalpinia bonduc* (L.) Roxb.	Kanta Karanja	Root bark	PID-III
68	*Cajanus cajan* (Linn.) Millsp. syn. *C. indicus* Spreng.	Adhaki	Root	QSIMP-XIII
69	*Calamus rotang* Linn.	Vetra	Rhizome	QSIMP-XIV
70	*Calotropis gigantea* (Linn.) R. Br.	Arka	Root	PID-I
		Arka	Root	PAD-II
		Calotropis	Root	PIRRD
		Alarka	Root	QSIMP- II
71	*Calotropis procera* (Ait.) Dryand. ssp. *hamiltonii* (Wight) Ali syn. *C. procera* auct. non (Ait.) Ait. f.	Arka	Root	PID-I
		Madar	Root bark	SSDUM-I
		Arka	Root	QSIMP-XIII
72	*Capparis sepiaria* Linn.	Himsra	Root	PID-III
		Kabar	Root bark	SSDUM-V
73	*Capparis zeylanica* Linn.	Vyagranakhee	Root	PID-II
74	*Cardiospermum halicacabum* Linn.	Indravalli	Whole plant	PAD-VI
		Kakadani	Whole plant	QSIMP-VI
75	*Carissa carandas* Linn.	Karamarda	Root	QSIMP-XIII
76	*Cassia fistula* Linn.	Aragvadha	Root	PID-I
		Aragvadha	Root	QSIMP-XIV
77	*Cassia obtusifolia* Linn.	Chakramarda	Root	PID-I
78	*Cassia occidenlalis* Linn.	Cassia	Root	PIRRD
		Kasamarda	Root	PID-I
79	*Celastrus paniculatus* Willd.	Malkangani	Root	MPWG
80	*Centaurea behen* Linn.	Behman Safaid	Root	SSDUM-V
81	*Centella asiatica* (Linn.) Urban syn. *C. coriacea* Nannf.; *Hydrocotyle asiatica* Linn.; *H. lanata* Linn.; *H. wightiana* Willd.	Aranyayiraka	Whole plant	QSIMP-VIII
82	*Cephaelis ipecacuanha* (Brot.) A. Rich	Ipecacuanha	Root	PIRRD
83	*Chenopodium ambrosioides* Linn.	Sugandha vastuka	Whole plant	QSIMP-X

84	*Chlorophytum arundinaceum* Baker.	Musli Sufaid	Root	SSDUM-II
		Sveta musli bhela	Tuberous root	QSIMP-IV
85	*Chonemorpha macrophylla* G. Don.	Murva	Root	PAD-II
86	*Cichorium intybus* Linn.	Bekh-e-Kasni	Root	SSDUM-II
		Kasani	Root	QSIMP- III
87	*Cissampelos pareira* Linn	Cissampelos Pareira	Root	SHD-II
		Cissampelos	Root	PIRRD
		Patha	Root	PAD-I
88	*Cissampelos pareira* Linn. var. *hirsuta* (Buch.-Ham. ex DC.) Forman syn. *C. pareira* sensu Hook. f., p.p.	Patha	Root	QSIMP- III
89	*Citrullus colocynthis* (Linn.) Schrad.	Hanzal	Root	SSDUM-V
90	*Clerodendron indicum* Kunt.	Clerodendron	Root	PIRRD
91	*Clerodendrum serratum* (Linn.) Moon	Bharangi	Root	QSIMP- III
92	*Clitoria ternatea* Linn.	Aprajita	Root	PAD-VIII
93	*Coccinia indica* W & A	Bimbi	Root	PAD-XI
94	*Coleus forskohlii* (Willd.) Briq. syn. *C. barbatus* (Andr.) Benth.	Gandeer	Root	QSIMP-IV
95	*Convolvulus microphyllus* Sieb. ex Spreng. syn. *C. pluricaulis* Choisy	Sankhapuspi	Whole plant	QSIMP- II
96	*Coptis teeta* Wall.	Coptis	Root	PIRRD
		Mamira	Rhizome	PNLP
97	*Coscinium fenestratum* (Gaertn.) Colebr.	Jhar-I- Haldi	Root	MPWG
		Kalambaka	Root	QSIMP- II
98	*Costus speciosus* (Koen. ex Retz.) J. E. Smith	Kemuka	Root, Rhizome	PID-I
		Kabuka	Rhizome	QSIMP-VII
99	*Cratavaeva religiosa* Forst.	Varuna	Root bark	PAD-IX
		Varun	Root	SPAD
100	*Crateva magna* (Lour.)DC.	Barun	Root	MPWG
101	*Crateva nurvala* Buch. Ham.	Varun	Root	PID-II
102	*Crotalaria juncea*	Sanah	Root	PAD-XI
103	*Cryptolepis buchanani* Roem. &Schult.	Sariva	Root	PID-II
		Krsnasariva	Root	QSIMP-V
104	*Curculigo orchioides* Gaertn.	Musli Siyah	Rhizome	SSDUM-II
		Musali	Root stock	PID-II
		Musali	Root stock	PAD-VI
105	*Curcuma amada* Roxb.	Amragandhi haridra	Rhizome\ Root	PID-I
		Amba Haldi	Rhizome	SSDUM-IV
		Karpura Haridra	Rhizome	QSIMP- I

106	*Curcuma aromatica* Salisb.	Vahaharidra	Rhizome	QSIMP-VI
107	*Curcuma longa* Linn. syn. *C. domestica* Valeton	Haridra	Rhizome	PID-I
		Haridra	Rhizome	PAD-X
		Haldi	Rhizome	IHP
		Curcuma	Rhizome	PIRRD
		Durva	Rhizome	QSIMP-VIII
108	*Curcuma zedoaria* Rosc.	Zarambad	Rhizome	SSDUM-II
		Sati	Rhizome	PAD-VIII
		Karacura	Rhizome	QSIMP-VII
109	*Cuscuta reflexa* Roxb.	Akasarvalli	Whole plant	QSIMP-V
110	*Cyclea peltata* Diels	Patha	Root	PAD-I
111	*Cymbopogon Jwarancusa* Jones Schultz	Izkhar	Root	SSDUM-III
112	*Cymbopogon martini* (Roxb.) W. Wats.	Rohisa	Whole plant	QSIMP-XIII
113	*Cynodon dactylon* (Linn.) Pers.	Durva	Whole plant	PAD-VI
		Durva	Root	QSIMP-IV
		Amalaki	Whole plant	QSIMP-VIII
114	*Cyperus rotundus* Linn	Cyperus	Root	PIRRD
		Musta	Rhizome	PAD-XI
		Nagarmotha	Root	SSDUM-III
		Mustaka	Rhizome	QSIMP- I
115	*Cyperus scariosus* R. Br.	Nagarmusta	Tuber root	QSIMP-XIV
116	*Dactylorhiza hatagirea* (D.Don) Soo syn. *Orchis latifolia* auct. non Linn.	Amunjatakah	Tuberous root	QSIMP- II
		Salampanja	Rhizome	PNLP
117	*Datura metel* Linn. syn. *D. fastuosa* Linn.; *D. alba* Nees; *D. fastuosa* Linn. *var. alba* (Nees) Clarke	Dhattorah	Root	PAD-X
		Dhattura	Root	QSIMP-XIII
118	*Decalepis hamiltonii* Wight & Arn.	Sariva	Root	PID-II
119	*Delphinium denudatum* Wall.	Jadwar	Root	SSDUM-II
120	*Derris elliptica* (Roxb.) Benth	Derris	Root	PIRRD
121	*Derris indica* (Lamk.) Bennet syn. *Pongamia glabra* Vent.; *P. pinnata* (Linn.) Pierre	Karanja	Root	QSIMP-X
122	*Desmodium gangeticum* (Linn.) DC. syn. *Hedysarum gangeticum* Linn.	Prsaniparni	Root	PAD-II
		Desmodium Gangeticum	Root	SHD-IV
		Salaparni	Root	QSIMP-IX
123	*Desmodium latifolium* D. C.	Prsaniparni	Root	PAD-II
124	*Desmodium triflorum* DC.	Tripadi	Root	PAD-XII
125	*Didymocarpus pedicellatus* R. Br. (pedicellata)	Silapuspa	Whole plant	QSIMP-V

126	*Dioscorea bulbifera* Linn. syn. *D. crispata* Roxb.; *D. sativa* sensu Hook. f. non Linn.; *D. pulchella* Roxb.; *D. versicolor* Buch.-Ham. ex Wall.	Trapura	Tuberous root	QSIMP-XI
127	*Dioscorea deltoidea* wall. Ex. Griseb	Krish(kash)	Rhizome	QSIMP- III
		Shingli-mingli	Rhizome	PNLP
128	*Dolichos biflorus* Linn.	Kulatthah	Root	PAD-XI
129	*Dregea volubilis* Benth.	Dregea	Root	PIRRD
130	*Dryopteris filix-mas* (Linn.) Schott syn. *Lastrea filix-mas* (Linn.) Presl sensu Bedd., p.p.	Sphitakitari	Rhizome with frond bases	QSIMP-XII
131	*Eclipta Prostrata* (L.) *Eclipta prostrata* (Linn.) Linn. syn. *Verbesina prostrata* Linn.; *E. alba* (Linn.) Hassk.; *E. erecta* Linn.	Bhangra	Whole plant	IHP
		Bhrngaraja	Whole plant	QSIMP-IX
132	*Elephantopus scaber* Linn.	Gujihava	Root	PAD-XII
133	*Embelia ribes* Burm. f.	Vaividang	Root	MPWG
134	*Emilia sonchifolia* DC.	Sasasruti	Whole plant	PAD-VI
135	*Enicostemma hyssopifolium* (Willd.) Verd. syn. *E. littorale* Blume	Mamjjaka	Whole plant (Root and vegetative part)	QSIMP- III
136	*Eupatorium triplinerve* Vahl syn. *E. ayapana* Vent.	Varahikanda	Whole plant	QSIMP-XI
137	*Euphorbia hirta* Linn. syn. *E. pilulifera* auct. non Linn.	Dudhi	Whole plant	SSDUM-I
		Brhat Dugdhika	Whole plant	QSIMP-X
138	*Euphorbia hypericifolia* Linn.	Euphorbia Hypericifolia	Root	SHD-IV
139	*Euphorbia prostrata* W. Ait.	Dugdhika bheda	Whole plant	QSIMP- II
140	*Euphorbia thymifolia* Linn.	Dudhi khurd	Whole plant	SSDUM-I
		Dugdhika	Whole plant	QSIMP- III
141	*Exacum tetragonum* Roxb. syn. *E. bicolor* Roxb.	Avartani	Whole plant	QSIMP-VIII
142	*Fagonia indica* Burm. f. syn. *F. cretica* auct. non Linn.; *F. arabica* auct. non Linn.	Duralabha	Whole plant	QSIMP-IX
143	*Fagopyrum esculentum* Moench	Fagopyrum Esculentum	Root	SHD-III
144	*Foeniculum vulgare* Mill.	Bekh-e-Badiyan	Root	SSDUM-III
145	*Frerea indica* Dalzell	Milkweed	Whole plant	PNLP

146	*Fumaria indica* (Haussk.) Pugsley syn. *F. parviflora* auct. non. Lam.; *F. vaillantii* (Loisel.) Hook. f. & Thoms.	Snuhi	Whole plant	QSIMP-XI
147	*Gentiana kurroo* Royle	Gentiana	Root	PIRRD
		Kutki	Rhizome	PNLP
148	*Gentiana lutea* Linn.	Juntiana	Rhizome	SSDUM-II
149	*Geranium wallichianum* D. Don ex Sweet	Laljari	Root	QSIMP-XIV
150	*Getonia floribunda* Roxb. syn. *Calycopteris floribunda* (Roxb.) Lamk. ex Poir.	Pullani	Root	QSIMP-XII
151	*Gloriosa superba* Linn.	Langali	Root, Rhizome	PID-II
		Gloriosa	Root, Rhizome	PIRRD
152	*Glycyrrhiza glabra* Linn. syn. *Liquirita officinalis* Moench.	Licorice	Root	QASIMP
		Yastimadhu	Rhizome & Tuberous	PAD-I
		Asl-us-soos	Root	SSDUM-V
		Gdycyrrhiza	Root	PIRRD
		Yastimandha	Root, Stolon	QSIMP-IX
153	*Gmelina arborea* Roxb.	Gmelina	Root	PIRRD
		Kasmari	Root	PAD-II
		Gambhari	Root	SPAD
		Gambhari	Root bark	MPBD-I
		Parpata	Root	QSIMP-XI
154	*Gossypium arboreum* Linn.	Karpasah	Root	PAD-X
155	*Hedychium spicatum* Buch.-Ham. ex J.E Smith syn. *H. acuminatum* Rosc.	Sati	Rhizome	QSIMP-IX
156	*Helicteres isora* Linn.	Marorphali	Root	SSDUM-V
157	*Heliotropium indicum* Linn.	Hastisundi	Whole plant	QSIMP-XII
158	*Hemidesmus indicus* (Linn.) R.Br.	Anantamul	Root	MPWG
		Sariba	Root	PAD-I
		Sariva	Root	PID-II
		Hemidesmus	Root	PIRRD
		Anantamula	Root	QSIMP- II
159	*Hibiscus rosa-simnsis* Linn.	Hibiscu	Root	PIRRD
		Japa	Root	PID-I
160	*Hibiscus sabdariffa* Linn.	Gambhari	Root	QSIMP-XI
161	*Holarrhena antidysenterica* Linn. Wall	Kutaj	Root	SPAD
		Kutaja	Root bark	PAD-IV
162	*Holarrhena pubescens* (Buch.Ham.) Wall.ex Don	Kurchi	Root	MPWG
163	*Holostemma ada-kodien* Schult.	Chirvel	Root	MPWG

164	*Holostemma annulare* K. Schum.	Jivanti	Root	PAD-X
165	*Hygrophila auriculata* (K. Schum.) Heine syn. *Asteracantha longifolia* (Linn.) Nees; *Hygrophila spinosa* T. Anders.; *Barleria auriculata* K. Schum.	Kokilaksa	Root	QSIMP-VII
		Kokilaksa	Whole plant	QSIMP-IX
		Hygrophila Spinose	Root	SHD-IV
166	*Ichnocarpus frutescens* (Linn.) R.Br.	Sariva	Root	PID-II
		Sariba	Root	PAD-I
167	*Indigofera sumatrana* Gaertn.	Nili	Root	PAD-IV
168	*Indigofera tinctoria* Linn.	Nili	Root	PAD-IV
169	*Inula racemosa* Hook. f.	Puskarmula	Root	QSIMP-IV
170	*Ipomaea sepiaria* Koenig	Laksmana	Root	PAD-III
171	*Ipomoea digitata* Linn. syn. *I. paniculata* R. Br., non Burm.	Ksiraviddvi	Tuberous root	QSIMP-VI
172	*Ipomoea pescaprae* Linn. Sw.	Vriddhadaruka	Root	PID-II
173	*Ipomoea pes-caprae* Sweet.	Vrddhadaraka	Root	PAD-VIII
174	*Ipomoea petaloidea* Chois.	Vriddhadaruka	Root	PID-II
175	*Ipomoea purga* Hayne	Jalap	Root	SSDUM-IV
176	*Iris ensata* Thunb.	Irsa	Root	SSDUM-III
177	*Ixora coccinea* Linn.	Bandhukah	Root	PAD-XII
178	*Jatropha curcas* Linn.	Dravanti	Root	PID-I
179	*Juncus effusus* Linn.	Juncus Effusus	Root	SHD-I
180	*Kaempferia galanga* Linn.	Chandramula (Hin.)	Rhizome	QSIMP-VII
		Sati	Rhizome	PAD-VIII
		Chandra mula	Rhizome	PNLP
181	*Kaempferia rotunda* Linn.	Bhuyi champa	Rhizome, Root	MPWG
182	*Killinga monocephala* Rottb.	Mustha	Root stock	PAD-XI
183	*Leptadenia reticulata* (Retz.) Wight & Arn.	Jivanti	Root	QSIMP-XII
184	*Leucas cephalotes* (Roth) Spreng.	Dronapuspi	Whole plant	QSIMP- II
185	*Limonia acidissima* Linn.	Katbel	Root	MPWG
186	*Lippia nodiflora* Rich.	Bukun Buti	Whole plant	SSDUM-IV
187	*Lochnera rosea* (L.) Reichb Linn.	Sadompushpa	Root	PAD-XII
188	*Luffa acutangula* (Linn.) Roxb. syn. *Cucumis acutangulus* Linn.	Kosataki	Whole plant	QSIMP-IX
189	*Manihot esculenta* Crantz	Kalpakanda	Tuberous root	QSIMP-XII

190	*Marsdenia tenacissima* Wt. & Arn.	Trivrit	Root	PID-II
191	*Merremia hastata* Hallier f.	Prasarani	Root	PAD-VI
192	*Merremia tridentata* Hallier f.	Prasarani	Root	PAD-VI
193	*Merremia turpethum* (Linn.) Shaw & Bhatt syn. *Ipomoea turpethum* (Linn.) R. Br.;*Operculina turpethum* (Linn.) Silva Manso	Ttivrt	Root	QSIMP- III
194	*Merremia tridentata* (Linn.) Hall. f. syn. *Ipomoea tridentata* (Linn.) Roth	Matsyapatrika	Whole plant	QSIMP-XII
195	*Mimosa pudica* Linn.	Mimosa	Root	PIRRD
		Mimosa Pudica	Root	SHD-I
		Lajjalu	Leaf	PAD-XI
		Lajjalu	Whole plant	PAD-VI
196	*Moringa oleifera* Lamk.	Sigru	Root bark	PAD-IV
197	*Moringa pterygosperma*, Gaertn	Moringa	Root	PIRRD
198	*Morus acedosa* Griff.	Shahtoot	Root	SSDUM-V
199	*Mucuna pruriens* (Linn.) DC. syn. *M. prurita* Hook.	Atasi	Root	QSIMP-XI
200	*Mucuna prurita* Hook	Kapikacchu	Root	PAD-V
201	*Murraya koenigii* (L.) Spreng,	Kaidarya	Root	PID-I
		Kaidarya	Root bark	PAD-III
202	*Murraya paniculata* (L.) Jack	Kaidarya	Root	PID-I
203	*Nardostachys jatamansi* DC. syn. *N. grandiflora* DC.	Jatamansi	Rhizome	PID-III
		Jatamansi	Rhizome	IHP
		Jatamansi	Rhizome	PNLP
		Jatamansi	Rhizome	QSIMP-X
		Nardostachys	Root	PIRRD
204	*Nelumbo nucifera* Gaertn.	Pundarika	Rhizome	PID-II
205	*Nepeta hindostana* (Roth.) Haines	Badranjboya	Root	SSDUM-V
206	*Nerium indicum* Mill.	Karavira	Root	PID-I
207	*Nerium odorum* Sol.	Nerium	Root	PIRRD
208	*Ocimum kilimands charicum* Guerke	Karpurtihsi	Whole plant	QSIMP-IX
209	*Oenothera biennis* Linn	Oenothera	Root	SHD-IV
210	*Oldenlandia corymbosa* Linn.	Parpata	Root	PAD-XII
211	*Onosma echioides* Linn.	Ratanjot	Root	SSDUM-V
212	*Operculina turpethum* (Linn.) Silva Manso	Turbud	Root	SSDUM-I
		Trivrit	Root	PID-II
		Operculina	Root	PIRRD

213	*Orchis latifolia* Linn.	Salab	Dried Tuberous root	SSDUM-III
214	*Oroxylum indicum* (Linn.) Vent. syn. *Bignonia indica* Linn.	Sonapatha	Root	MPWG
		S'yonakah	Root	PAD-II
		Syonaka	Root	QSIMP-X
215	*Oxalis corniculata* Linn.	Cangeri	Whole plant	QSIMP-V
216	*Paederia foetida* Linn.	Paederia	Root	PIRRD
		Prasarini	Root	PID-II
217	*Paederia scandens* (Lour.) Merr. syn. *P. foetida* auct. non Linn.; *P. tomentosa* Blume	Bhumyamlaku	Whole plant	QSIMP-VIII
218	*Panax pseudo-ginseng* wall	Jinseng	Rhizome	PNLP
219	*Pandanus odoratissimus* Linn. f. syn. *P. tectorius* auct. non Soland. ex Parkinson; *P. fascicularis* Lamk.	Ketaki	Stilt root	QSIMP-XIII
220	*Pavetta indica* Linn.	Pavetta	Root	PIRRD
221	*Pavonia odorata* Willd.	Kasa visa	Whole plant	QSIMP-XI
222	*Pedalium murex* Linn.	Brihat Goksura	Root	PID-III
223	*Pergularia daemia* (Forsk.) Chiov.	Uttamarani	Root	PID-II
		Uthamakanya	Root	PAD-XI
224	*Peristrophe paniculata* (Forssk.) Brummitt syn. P. *bicalyculata* (Retz.) Nees	Kakajangha	Whole plant	QSIMP-V
225	*Phaseolus adenanthus* G. F. Mey.	Mudgaparni	Root	PAD-VII
226	*Phyla nodiflora* (Linn.) Greene syn. *Verbena nodiflora* Linn.; *Lippia nodiflora* (Linn.) A. Rich.	Jalapippali	Whole plant	QSIMP-X
227	*Phyllanthus fraternus* Webst. syn. *P. niruri* auct. pl. non Linn.	Tamalaki	Whole plant	QSIMP-XIV
228	*Phyllanthus maderaspatensis* Linn.	Bhudhairi	Whole plant	QSIMP- II
229	*Physalis minima* Linn.	Tankari	Root	PAD-XII
230	*Picrorhiza kurroa* (Kutaki) Royle ex Benth	Kutti	Rhizome & Root	IHP
		Katuki	Rhizome, Root	PID-I
		Picrorhiza	Root	PIRRD
		Kutki	Rhizome &Root	PNLP
		Katuka	Rhizome, Root	QSIMP-IX

231	*Piper betle* Linn.	Tambuli	Root	PAD-IX
232	*Piper longum* Linn	Pippall	Root	PAD-IX
233	*Piper nigrum* Linn.	Maricam	Root	PAD-IX
234	*Plectranthus barbatus* Andrews	Coleus	Root	QASIMP
235	*Pluchea lanceolate* Oliver & Hiern.	Rasna	Root, Root stock,	PID-II
236	*Plumbago indica* Linn. syn. *P. rosea* Linn.	Lalchitra	Root	MPWG
		Rakta Citraka	Root	QSIMP-VII
237	*Plumbago rosea* Linn.	Citraka	Root	PAD-IV
238	*Plumbago zeylanica* L.	Plumbago	Root	PIRRD
		Citraka	Root	PAD-IV
		Citraka	Root	QSIMP-VII
239	*Podophyllum emodi* Wall.	Podophyllum	Root	PIRRD
240	*Podophyllum hexandrum* Royle ex Camb. syn. *P. emodi* Wall. ex Honigberger; *Sinopodophyllum emodi* (Wall. ex Honigberger) T. S. Ying	Ban-Kakri	Rhizome and Root	IHP
		Papra	Rhizome and Root	PNLP
		Vanatrapusi	Root, Rhizome	QSIMP-IV
241	*Polygala chinensis* Linn.	Chinensis	Root	PIRRD
242	*Polypodium vulgare* Linn.	Bisfaij	Rhizome	SSDUM-III
243	*Pongamia glabra* Vent.	Karanja	Root bark	PAD-IV
244	*Portulaca oleracea* Linn.	Brhat lonika	Whole plant	QSIMP-XIII
245	*Premna iniegrifolia* Linn.	Premna	Root	PIRRD
246	*Premna serratifolia* Linn.	Agnimanthah	Root	PAD-II
247	*Pseudarthria viscida* (Linn.) Wight & Arn. syn. *Hedysarum viscidum* Linn.	Saliparni	Root	PAD-II
		Soopgandha	Root	QSIMP-VIII
248	*Punica garnatum* Linn.	Dadima	Root bark	PID-III
		Post Bekh-e-Anar	Root bark	SSDUM-III
		Dadima	Root bark	MPBD-I
249	*Radermachera xylocarpaK.* Schum.	Patala	Root bark	PAD-II
250	*Randia uliginosa* DC.	Randia	Root	PIRRD
251	*Raphanus sativus* Linn.	Mulaka	Root	QSIMP-X
252	*Rauvolfia serpentina* (Linn.) Benth. ex Kurz syn. *Ophioxylon serpentinum* Linn.	Chota chand	Root	PNLP
		Kantakari	Root	QSIMP-VIII
		Chota-chand	Root	IHP
		Rauwolfia	Root	PIRRD
		Sarpagandhi	Root	PAD-XII
253	*Rauvolfia tetraphylla* Linn. syn. *R. canescens* Linn.	Bharachandrika (Hindi)	Root	QSIMP- II

254	*Rheum australe* D. Don. syn. *R. webbianum* Royle; *R. emodi* Wall. ex Meissn.		Rhizome, Root	QSIMP-IX
255	*Rheum emodi* Wall.	Rheum	Rhizome	PIRRD
		Rewandchini	Root	SSDUM-III
		Revand chini	Rhizome	IHP
256	*Ricinus communis* Linn. syn. *R. inermis* Jacq.	Erandah	Root	PAD-IX
		Arand	Root	IHP
		Eranda	Root	PID-I
		Eranda	Root	QSIMP-X
257	*Robinia pseudoacacia* Linn	Robinia Pseudoacacia	Root bark	SHD-III
258	*Rotula aquatica* Lour.	Pashanabheda	Root	MPWG
259	*Rubia cordifola* Linn. *Rubia cordifolia* Linn. *Rubia cordifolia* Linn. syn. *R. munjista* Roxb. ex Flem.	Majeeth	Root	SSDUM-IV
		Manjith	Root	MPWG
		Manjistha	Root	QSIMP- III
260	*Salyia haematodes* Linn.	Behman Surkh	Root	SSDUM-V
261	*Sanseviera roxburghiana* Schult. f.	Murva	Rhizome	PAD-II
262	*Saraca asoca* (Roxb.) de Wilde	Asok	Root	MPWG
263	*Saussurea costus* (Falc.) Lipsch. syn. *S. lappa* (Decne.) C.B. Clarke	Kuth	Root	PNLP
		Kustha	Root	QSIMP-IV
264	*Saussurea lappa* Clarke.	Kooth	Root	IHP
		Saussurea	Root	PIRRD
265	*Sida acuta* Burm. f. ssp. *acuta* syn. *S. carpinifolia* sensu Masters (non Linn.)	Bala	Root	PAD-V
		Bala-Sveta	Root	QSIMP- I
266	*Sida cordifolia* Linn.	Bala	Root	PAD-V
		Bariar	Root	IHP
		Bala	Root	QSIMP-IX
267	*Sida retusa* Linn.	Bala	Root	PAD-V
268	*Sida rhombifolia* Linn. ssp. *rhombifolia*	Bala	Root	PAD-V
		Mahabala	Root	QSIMP- II
269	*Sida rhomboidea* Roxb.	Bala	Root	PAD-V
270	*Sida spinosa* Linn.	Bala	Root	PAD-V
271	*Sidaveronica veronicaefolia* Lamk.	Bala	Root	PAD-V
272	*Siegesbeckia orientalis* Linn.	Siegesbeckia Orientalis	Root	SHD-II
273	*Smilax china* Linn.	Chobchini	Rhizome/ Tubers	SSDUM-I
274	*Solanium indicum* Linn.	Brhati	Root	PAD-IV

275	*Solanum aculeatissimum* Jacq.	Brhati	Root	PAD-IV
276	*Solanum americanum* Linn.	Makoi	Whole plant	IHP
277	*Solanum anguivi* Lamk. syn. *S. violaceum* Ortega; *S. sodomeum* Linn.; *S. indicumauct.* non Linn.	Brhati	Whole plant	QSIMP-VII
278	*Solanum indicum* Linn.	Brihati	Root	SPAD
		Brhati	Root	PAD-IV
279	*Solanum melongena* Linn.	Brhati	Root	PAD-IV
280	*Solanum nigrum* Linn.	Kakamaci	Root	PAD-IV
281	*Solanum surattense* Burm. f.	Kantakari	Root	PID-III
282	*Solanum torvum* Swartz	Brhati	Root	PAD-IV
		Sveta Brhati	Whole plant	QSIMP-VII
283	*Solanum villosum* Mill. ssp. *villosum Edmonds* syn. *S. nigrum* sensu Clarke, p.p., non Linn.	Kakamaci	Whole plant	QSIMP-VII
284	*Solanum virginiatum* Linn. syn. *S. xanthocarpum* Schrad. & Wendl.; *S. surattense* Burm. f.	Gulu	Whole plant	QSIMP-VIII
285	*Solanum xanthocarpum* Sch & Wendl.	Brhati	Root	PAD-IV
		Kantkari	Root	SPAD
		Kateli	Whole plant	IHP
		Solanum	Root	PIRRD
286	*Stephania hernandifolia* Walp.	Stephania	Root	PIRRD
287	*Stereospermum suaveolens* (Roxb.) DC. syn. *S. chelonoides* sensu Clarke, p.p. non (Linn. f.) DC.	Patola	Root	QSIMP-VI
288	*Stereospermum tetragonum* D.C.	Patala	Root bark	PAD-II
289	*Swertia angustifolia* Buch.-Ham. ex D. Don	Lavanga	Whole plant	QSIMP-VIII
290	*Swertia chirayita* (Roxb. ex Fleming) Karsten syn. *S. chirata* Buch.-Ham. ex C.B. Clarke	Chirayata	Whole plant	IHP
		Chiretta	Whole plant	PNLP
		Kiratalikta	Whole plant	QSIMP-IX
291	*Tephrosia purpurea* (Linn.) Pers.	Sharpunkha	Root	PID-II
		Sarpunkha	Root	PAD-XI
		Sharpunkha	Root	SPAD
		Sharapunkha	Whole plant	QSIMP- I
292	*Thalictrum foliolosum* DC.	Mamiran	Rhizome/Root	SSDUM-III

293	*Thevetia peruviana* (Pers.) K. Schum. syn. *T. neriifolia Juss.* ex Steud.	Pitakaravirah	Root bark	QSIMP- II
294	*Tinospora cordifolia* (Willd.) Miers	Guduchi	Root	SPAD
		Guduchi	Root	PID-I
		Guduci	Root	PAD-VII
295	*Tinospora malabarica* Miers.	Guduci	Root	PAD-VII
296	*Tragia involucrata* Linn.	Duralabha	Root	PAD-VI
297	*Trianthema decandra* Linn. syn. *Zaleya decandra* (Linn.) Burm. f.		Whole plant	QSIMP-XI
298	*Trianthema portulacastrum* Linn. syn. *T. monogyna* Linn.	Punarnava	Root	PAD-V
		Svetapunarnava	Whole plant	QSIMP- II
299	*Tribulus terrestris* Linn.	Khar-e-khasak	Root	SSDUM-V
		Prsniparni	Root	QSIMP-VIII
300	*Trichosanthes dioica* Roxb.	Trichosanthes	Root	PIRRD
301	*Trichosanthes lobata* Roxb.	Jangali cicinda	Root	MPWG
302	*Tridax procumbens* Linn.	Ghamsa	Whole plant	QSIMP-X
303	*Tylophora asthmatica* W. & A.	Tylophora	Root	PIRRD
304	*Typha australis* K. Schum. & Thonn.	Gun drah	Rhizome	QSIMP-XIV
305	*Uraria picta* (Jacq.) Desv. ex DC. syn. *Hedysarum pictum* Jacq.	Sunthi	Root	QSIMP-VIII
306	*Urena lobata* Linn.	Bala	Root	PAD-V
307	*Valeriana jatamansi* Jones syn. *V. wallichii* DC.	Tagara	Root, Rhizome	QSIMP-IV
308	*Valeriana wallichi* DC.	Farasiyun	Root/Rhizome	SSDUM-V
		Valeriana	Root	PIRRD
309	*Vanda tessellate* (Roxb.) Hook. ex G. Don.	Rasna	Root, Root stock,	PID-II
310	*Vateria indica* Linn.	Ajakarna	Root	PID-I
311	*Vernonia conyzoides* DC. syn. *V. cinerea* auct. non Less.	Sohadevi	Whole plant	QSIMP-VII
312	*Vetiveria zizanioides* (Linn.) Nash syn. *Andropogon squarrosus* Hook. f., non Linn. f.	Usira	Root	QSIMP-IV
313	*Vigna pilosa* Baker.	Mudgaparni	Root	PAD-VII
314	*Viola odorata* Linn.	Banapsa	Whole plant	QSIMP-XIII
315	*Vitex negundo* Linn.	Nirgundi	Root	PAD-IX
		Nirgundi	Root	QSIMP-XI

316	*Withania somnifera* (L.) Dunal syn. *Physalis somnifera* Linn.	Ashwagandha	Root	QASIMP
		Withania Somnifera	Root	SHD-I
		Withania	Root	PIRRD
		Asavgandha	Root	PAD-VIII
		Ashwagandha	Root	SPAD
		Asgand	Root	SSDUM-III
		Asgandh	Root	IHP
		Asvagandha	Root	QSIMP-IX
317	*Zingiber officinale* (Wild.) Rose	Adrak	Rhizome	IHP
		Ardraka	Rhizome	PID-I
		Ardrakah	Rhizome	PAD-IX
		Zingiber	Root	PIRRD
		Sunthi	Rhizome	QSIMP-VIII

* Pharmacognosy of whole plant comprise aerial parts (Leaf, Stem, Flower, Fruit, Seed etc.) and underground parts (Root, Rhizome etc.).

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