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- Instructions to Contributors

Editorial

New drug development is highly tedious and arduously complex process entailing a lot of time and overweening cost along with the high rate of failure at every stage of development even after the drug has been marketed. Therefore the drug industry is facing serious challenge of innovation deficit. In conventional pharmacology (forward pharmacology) four phases of drug development; (i) discovery; (ii) pre-clinical studies; (iii) clinical trials and; (iv) post marketing surveillance (PMS) are considered mandatory. Thousands of molecules are tested through high throughput screening to find few putative molecules to be developed as drug but unfortunately most of them fail to pass the subsequent tests both in pre-clinical and clinical phase and often after the marketing of the drug. Liability to induce toxicity is another major problem with such drugs. In recent years, however, a paradigm shift in the field of drug development has taken place and an interdisciplinary approach called 'reverse pharmacology' has emerged as new discipline which can reduce three major bottlenecks – cost, time and toxicity – frequently encountered in forward pharmacology set-up of new drug development. This involves basic scientists, allopathic doctors and experts of traditional medicines in the course of new drug development. In this new approach, wisdom and practices of traditional medicine are assimilated with the knowledge of modern medicine and sophisticated technical know-how to find better and safer drug candidates. By using **'reverse pharmacology'** in ISM drugs the process of drug development can be substantially reduced to about 5 years from conventional 12-15 years. Unani medicine has a huge treasure of plant drugs and natural products, and their age-old practices with high degree of efficacy and safety. It is high time for Unani physicians and modern scientists to come together and put their collective efforts to find a solution to the problem of shortage of new drugs for a number of diseases that, hitherto, do not have effective and safe remedy.

All these ongoing investigations in the area of drug development 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, drug research, literary research, survey & cultivation of medicinal plants programme 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.

In view of an overwhelming response, *Hippocratic Journal of Unani Medicine* earlier published by Council 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.

The current issue of this journal (January - March 2017) provides 14 original and review papers in the areas of: Clinical studies, Fundamental and applied research, Safety studies, Quality control and drug standardization, Experimental pharmacology 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. Council 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 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.

New Delhi
June 3, 2017

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

Evaluation of Hypoglycemic Effect of Qurs-e-Ziabetus Khas in Alloxan Monohydrate Induced Diabetic Albino Rabbits

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Abstract

This study was carried out to evaluate the use of *Qurs-e-Ziabetus Khas* in hyper-glycaemia clinically. The anti-diabetic effect of *Qurs-e-Ziabetus Khas* was studied in adult healthy albino rabbits of either sex weighing 1.5-2 Kg at the doses of 400, 800 and 1200 mg/kg orally in the form of suspension. The animals were randomly divided into diabetic control, diabetic treated and standard groups, and each group consisting of 6 rabbits. Initially animals were made diabetic by injecting alloxan monohydrate at the dose of 150mg/Kg intravenously. The blood samples were obtained from the marginal ear veins at 0 h (initial), and after the test drug administration at 2, 3 and 6th hour. Blood glucose was estimated by the End Point O-Toluidine method. The maximum reduction of blood glucose occurred after 3rd hour of test drug administration at the dose of 1200 mg/kg orally as compared to animals of control group. The test drug was also compared with a standard drug glibenclamide in a dose of 1.5 mg/kg. The obtained data were analyzed by one way ANOVA with post hoc't' test. The findings indicate that the *Qurs-e-Ziabetus Khas* has significant effect in non insulin dependent diabetes mellitus and scientifically validated the claims of Unani physicians that this drug possesses antidiabetic effect.

Key words: Qurs-e-Ziabetus Khas, Hyper-glycaemia, Alloxan monohydrate, Antidiabetic

Introduction

Diabetes is the world's largest endocrine disease with deranged carbohydrate, lipid and protein metabolism. It is distinguished by irrelevant hyperglycemia produced by insufficiency of insulin at the cellular level (Sidhu, *et al*., 2014). It is reported that diabetic patient are increasing every year globally (Samyal *et al*., 2014), and inferring that more than 400 million people of the worldwide will be effected from hyperglycemia by 2030 (Samyal *et al*., 2014). The occurrence rate of diabetes in India is 1-5% (Sen *et al*., 2016). Statistical projection suggests that the number of diabetic patients will rise from 15 million in the year 1995 to 57 million in 2025, making India the country with the highest number of diabetics in the world (Shalam *et al*., 2006). It is a major public health problem in the developed as well as developing countries. It is ranked seventh among the leading causes of death, and third when all its fatal complications are taken into account. Large-vessel atherosclerosis is the most common cause of death in diabetes (Trivedi *et al*., 2004).

The phytoconstituents such as flavonoids and polyphenol components have an ability to enhance glucose transport and metabolism in muscle and/or to stimulate

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insulin secretion and play a chief role to delay digestion and absorption of carbohydrates lowering the postprandial glucose levels by inhibiting á-glucosidase and áamylase enzyme (Das *et al*., 2016 and Mukesh *et al*., 2013)

There is an increasing demand of antihyperglycemic natural products by patients, due to obvious side effects associated with the use of mainstream medicine such as insulin and oral hypoglycemic agents (Zhang *et al*., 2007 and Badole *et al*., 2006).

In the interest of patients there is a need for more effective, durable, safer and cost effective anti-diabetic agents. Therefore, the World Health Organization (WHO) has recommended the evaluation of plants effectiveness and suggested to use of herbal medicines where the conventional treatment of diabetes is not satisfactory (Samyal *et al*., 2014). This has lead to increasing demand of research on natural products with antidiabetic activity with minimal or no side effects (Singh *et al*., 2007). More than 400 traditional plants have been recorded to possess antidiabetic activity, but few of these are scientifically validated for their efficacy (Barhate and Kulkarni, 2007). Many herbal products, including several metals and minerals have been described for the cure of diabetes mellitus in ancient literature of Unani System of Medicine. Herbal preparations alone or in combination with oral hypoglycemic agents sometimes produce a good therapeutic response in some resistant cases where modern medicines alone fail (Ghosh *et al*., 2006).

Qurs-e-Ziabetus Khas (QZK) is a well known Unani Pharmacopoeial preparation mainly based on different medicinal plants used to treat diabetes since ancient times (Anonymous, 2006). But to the best of our knowledge this formulation is not evaluated scientifically for its antidiabetic activity. Therefore, this study was carried out to assess and scientifically validate the use of *Qurs-e-Ziabetus Khas* in hyper-glycaemia. The ingredients of QZK are Tabasheer (calcinated pith of *Bambusa arundinacea* Retz.), Satt-e-Gilo (dried extract of the stem of *Tinospora cordifolia* Miers.), Maghz-e-Khasta-e-Jamun (seed kernel of *Eugenia jambolana* Lam.), Gurmar Buti (*Gymnema sylvestre* Schult.), Kushta-e-Zumurrud (calx of Emerald), Kushta-e-Baiza-e-Murgh (calx of Egg shell) and Loab-e-Aspghol (Seeds mucilage of *Plantago ovata* Forsk) (Anonymous, 2006).

The anti-diabetic effect of *Qurs-e-Ziabetus Khas* was studied in adult healthy albino rabbits of either sex weighing 1.5-2 Kg at the doses of 400, 800 and 1200 mg/kg orally in the form of suspension. The animals were made diabetic using alloxan monohydrate (150 mg/kg; i.v.) and glibenclamide was used as a reference drug (1.5 mg/kg; p.o.).

Material and Methods

The study was conducted in the department of Ilmul Advia, A.K. Tibbiya College, AMU, Aligarh, during 2009-2010.

Preparation of Qurs-e-Ziabetus Khas

The ingredients of QZK are shown in table 1 (Anonymous, 2006).

Table 1: Ingredients of Qurs-e-Ziabetus Khas

S. No.	Ingredients	Weight (g)	Scientific Name
1.	Tabasheer	25	*Bambusa arundinacea*
2.	Satt-e-Gilo	25	*Tinospora cordifolia*
3.	Maghz-e-Khasta-e-Jamun	50	*Eugenia jambolana*
4.	Gurmar Buti	50	Gymnema sylvestre
5.	Kushta-e-Zumurrud	10	Calx of Emerald
6.	Kushta-e-Baiza-e-Murgh	10	Calx of Egg shell
7.	Loab-e-Aspghol	Q.S.	*Plantago ovata*

The QZK was prepared according to the following steps:-

Step I Procurement, authentication and identification of ingredients

Step II Processing of raw materials

Step III Preparation of Tablet (Qurs)

Step I: The raw materials were purchased from the local market of Aligarh and their identity, purity and quality were checked in the pharmacognosy section of the Department of Ilmul Advia, Faculty of Unani Medicine, AMU, Aligarh, and found at par with the standards of Unani and Ayurvedic Pharmacopoeia of India (Anonymous, 1986, 1992, 1997, 1999, 2001, 2007 and Vohora, 2008).

Step II: All the ingredients of QZK except Satt-e-Gilo and Loab-e-Aspghol were powdered in an electric grinder and passed through sieve number 80 to obtain fine powder. The fine powder alongwith Satt-e-Gilo was mixed properly and then excipient Loab-e-Aspghol was added and finally dough was made. Further this wet mass was made in to granules by passing through 12 mesh sieve and dried at room temperature (Anonymous, 1968; Anonymous, 1970).

Step III: Tablets were prepared of 500mg each according to the method described in the Pharmacopoeia of India (Anonymous, 1970), by automatic tablet making machine in Dawakhana Tibbiya College, AMU, Aligarh.

Animal maintenance

Experiments were carried out in healthy adult albino rabbits of either sex weighing 1.5-2 kg. The animals were kept in animal house of the Department of Ilmul Advia, Faculty of Unani Medicine, A.M.U., Aligarh, under hygienic and standard laboratory conditions at uniform temperature. All the animals were fed, Standard animal diet and water-ad-libitum.

Drugs and chemicals

Alloxan monohydrate was used for inducing diabetes at the dose of 150 mg/kg intravenously in healthy albino rabbits (Baily and Baily, 1943; Pincus *et al*., 1954; Bander *et al*., 1969). Glibenclamide (Daonil) was used as standard referent drug which was administered in a dose of 1.5 mg/kg orally to the animals.

Preparation of Test Drug Material

Fresh suspension of powdered drug was prepared in distilled water with 2% gum acacia powder (S.d. Fine Chemical Ltd.), which was administered orally in the animals with the help of feeding canula after shaking the suspension well. The dose for the albino rabbit was calculated by extrapolating the human dose of test drug by conversion factor of 12 for rabbit (Nair and Jacob, 2016). Hence the three different doses selected for the study of hypoglycaemic activity of test drug i.e. 400, 800 and 1200 mg/kg.

Hypoglycaemic activity of Qurs-e-Ziabetus Khas

The hypogycaemic effect of QZK was assessed on healthy albino rabbits. For study rabbits were divided into 5 groups and each group consisting of 6 albino rabbits. Group I served as control group and distilled water was given in the dose of 5 ml/kg orally. Group II is standard group and treated with referent drug Glibenclamide (Daonil) in the dose of 1.5 mg/kg orally. Group III, IV and V were test drug treated group and administered with the oral doses of QZK in 400, 800 and 1200 mg/kg respectively.

All the animals were fasted for 24h before alloxan injection. Diabetes was observed in the rabbits (fasting Blood Glucose Levels ranged from 200-250 mg/100ml) within 24h after injection of alloxan. The effect of the oral administration of QZK was observed in Group III, IV and V for 6h after drug administration. The blood samples of all the groups were taken from the marginal ear veins at 0h (before treatment), then at 2, 3 and 6h after the treatment. Serum was separated and serum glucose level was estimated by the End Point O-Toluidine Method, (Mukherjee, 1997; Hultman, 1959). The rabbits were fed water only during experiments.

Procedure

Bloods were collected in to test tubes. Serums were separated from blood by centrifuging the blood at 5000 rpm for 15 minutes in centrifuging machine. Then three test tubes were labelled as B for blank, S for standard and T for test (unknown) and the following reagents were pipetted into them as shown in table 2.

Table 2: Mixing of reagents in different test tubes

S. No.	Reagents	B	S	T
1.	Glucose reagents	5.0 ml	5.0 ml	5.0 ml
2.	Distilled water	100 µl	–	–
3.	Glucose standard	–	100 µl	–
4.	Specimen (serum)	–	–	100 µl

The contents in test tubes were mixed by lateral shaking of each test tube separately. All test tubes were put in to vigorously boiling water bath at 1000C for exactly 9 minutes, and then test tubes were removed quickly and cooled to room temperature by placing them in cold water for 3 minutes. The contents of tubes were transferred to cuvette and ABSORBANCE (O.D) of all tubes were measured against blank adjusted to 630 ± 20 nm on the filter wheel using Lab System Analyzer.

Calculation

The concentration of glucose in serum of unknown sample was calculated by the following formula:-

$$\frac{R.T}{R.S} x\,100 = mg/dl$$

Where, R.T = optical density of unknown sample

R.S = optical density of standard solution

Statistical Analysis

All the data were analyzed by one way-Analysis of variance (ANOVA) with post hoc 't' test.

Results

Control group: This group doesn't get any medication except distilled water. Therefore, there is no significant difference in serum glucose level before and after the treatment. The results are shown in table 3.

Standard group: In standard group the glucose level in serum reduced significantly after 3h ($P<0.001$) and continued for 6h when compared with control group. After the 6^{th} of the treatment, glucose level slightly increased. The results are presented in table 3.

Test drug treated groups: QZK in the doses of 400 and 800mg/kg doesn't show any significant reduction in serum glucose level in any animal at any time interval in comparison to control group. While the animals of group treated with the dose of 1200mg/kg of QZK shows significant difference in serum glucose level after 3h ($P<0.05$) of test drug administration, when compared to control group. However

there is an insignificant rise in serum glucose level after 6h of treatment. The results are depicted in table 3.

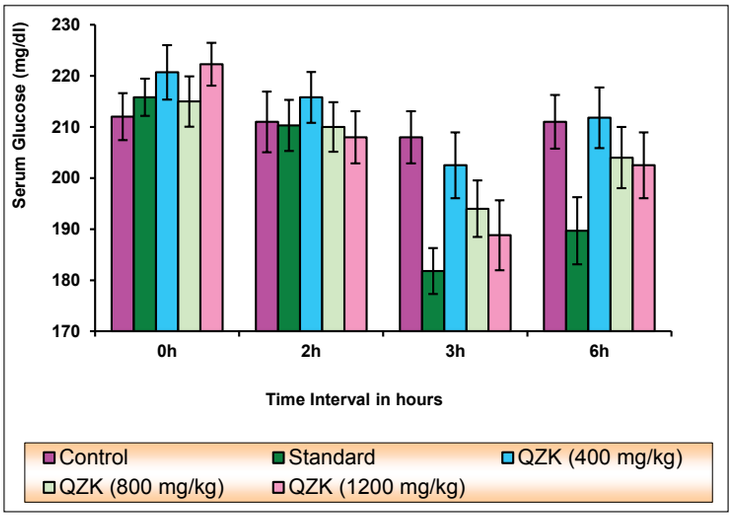
The comparison of the efficacy of test drug groups QZK in all the given doses with standard and control group has also been depicted in figure 1.

Table 3: Serum glucose level of different group before and after the treatment

Group	Initial (Mean ± SE)	Serum Glucose Levels (mg/dl) (Mean ± SE)		
	0h	2h	3h	6h
Control	212 ± 4.6	211 ± 5.95	208 ± 5.10	211 ± 5.26
Standard	215.8 ± 3.64	210.3 ± 5.02	181.8 ± 4.48***	189.7±6.57**
QZK (400 mg/kg)	220.7 ± 5.34	215.8 ± 4.97	202.5 ± 6.44	211.8 ± 5.95
QZK (800 mg/kg)	215 ± 4.93	210 ± 4.85	194 ± 5.55	204 ± 6.00
QZK (1200 mg/kg)	222.3 ± 4.20	208 ± 5.10	188.8 ± 6.85*	202.5 ± 6.44

(Tabulated values are mean ± SE; n=6; * P<0.05; ** P<0.01; *** P<0.001)

Fig. 1: Comparision of Effect of QZK in different doses (400, 800 and 1200 mg/kg) with Glibenclamide (1.5 mg/kg) and control on Serum Glucose Levels in Diabetic Rabbits



Discussion

Diabetes is a group of Syndromes characterized by hyperglycemia, due to altered metabolism of lipids, carbohydrates and proteins in result of complete or relative insufficiency of insulin secretion or insulin action (Satyanarayana *et al.*, 2007). Consumption of calorie-rich diet, obesity and sedentary lifestyle led to a tremendous increase in the number of diabetics' worldwide (Asulander *et al.*, 2002).

Presently two main groups of substances are recognized as oral hypoglycemic agents. They are certain sulphonamide derivatives (Sulphonylureas) and

guanidine derivatives (Biguanides). They are being used by 30% of all diabetics, but produce some undesirable effects such as vertigo, headache, gastric and hepatic disorders, poor renal functions, vit. B_{12} deficiency and cardiac disorders etc. (Goodman and Gilman, 1992; Laurence *et al*., 1997).

However, hyperglycemia can be treated quickly with allopathic drugs but at the same time they may cause various side effects like hypoglycemia, peripheral neuropathy and gastrointestinal disturbances etc. To avoid these side effects both patient and researchers are more eager to get and to investigate the new alternate method to cure the hyperglycemic condition. So, herbal medicines are gaining importance because of least adverse effects. In India plants were used for health care since 5000 years. In Indian system of medicine, crude drugs are obtained from plants and there are about 8000 herbal remedies for human ailments, besides the numerous plants used in folk medicine by tribal and rural people (Chikaraddy and Maniyar, 2017).

Hence this study has been undertaken to evaluate the hypoglycemic activity of Qurs Ziabitus Khas. All the ingredients of QZK viz. Satt-e-Gilo, Maghz-e-Khasta-e-Jamun, Gurmar Buti, Kushta-e-Zumurrud, Kushta-e-Baiza-e-Murgh and Loab-e-Aspghol are reported to have antidiabetic activity (Modak *et al*., 2007, Dymock *et al*., 1891, Rustenbeck, 2007, Kabiruddin, 1967, Said, 1997 and Ceranic *et al*., 2006) except Tabasheer (calcinated pith of *Bambusa arundinacea*) but the ethanolic extract of leaves of Bambusa arundinacea have been reported to possess hypoglycemic activity in alloxan induced diabetic rabbits (Gupta *et al*., 2004).

Study reveals that the test drug in the multiple doses of 400, 800 and 1200 mg/kg reduced the blood glucose level in alloxan induced diabetic rabbits from the beginning of 2nd hour. While the maximum reduction of blood glucose level seen after 3rd hour. Further the significant effect was produced by the dose of 1200 mg/kg ($P<0.05$) at 3rd hour against control group. The possible mechanism of action of the test drug may be like that of glibenclamide. The test drug may acts by stimulating the β-cells of the Pancreas which stimulate the secretion of insulin and thereby reduce the blood glucose level.

Conclusion

The test drug (QZK) appears to be quite safe, comprehensive, as it will produce the hypoglycaemic effect and can be used effectively for the treatment of diabetes.

The results of this study suggest that the test drug may be effective in non insulin dependent diabetes mellitus (NIDDM) at all the doses while having maximum effect at1200 mg/kg. The study also validates the description of Unani literature as Qurs-e-Ziabetus Khas has been described to possess antidiabetic activity. This study also substantiates the use of this drug as antidiabetic agent in clinical

practice by Unani physicians. Further to say that there should be more studies conducted on QZK to ascertain its exact mechanism of action and the role of its phytochemical constituents for anti-hyperglycemic activity.

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Interplay of *Arkān Arba´a* - An Understanding Towards the Basic Design of Natural Substances as Discussed in Unani Medicine

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Abstract

The theory and practices of Unani system of medicine are based on logic and philosophy that is why observation and reasoning have been used as important tools for its exposition. Therefore for proper understanding of Unani system of medicine, knowledge of traditional logic and philosophy is a prerequisite. However, in present scientific era Unani fundamentals are also required to be comprehended in the light of contemporary sciences. The present paper is an attempt towards the understanding of basic precursors of life and universe as stated in literature of Unani medicine and contemporary sciences.

Keywords: Ajzā Awwaliyya, Arkan, Element, Kafiyāt

Introduction

All physical things exist due to presence of primordial matter in a specific form and with unique configuration. This necessitates existence of primordial matter (*Hiula*), form (surate nauyiah) and configuration (surate jismiya) for existence of substances (Tabri, 2002). Since the substances are diverse in term of organization and number, therefore philosophers and researchers picked up common threads to arrive at the basic building blocks or *Juzie Ula*. Various theories were put forwards to explain the diversity in number of existing things and their organization.

From very beginning, a human has always been intrigued to know about him and the universe. How a man was created and universe was crafted? The placating theory of spontaneous generation seemed to give an implication to this enduring enquiry over thousands of years.

In antique China, people imagined that aphids were unexpectedly created from bamboos. The Indian texts revealed unprompted formation of flies from mud and sweat, whereas Babylonian writing pointed out that dirt from canals was supposed to have life in the form of worms (Brack, 1998).

Roman and Greek scholars tried to solve the problems someway and stated that life was inherent to matter; it was unending and appeared all at once, whenever the conditions were favourable. These ideas were clearly stated by Thales, Empedocles, Pythagoras, Democritus, Epicurus, Lucretius, and even by Plato. Aristotle after critically evaluating different claims developed a relatively different theory. Famous thinkers like Newton, Descartes, and Bacon supported the idea of unprompted generation (Brack, 1998). In primitive epoch, different concepts and ideas were perceived by sages from time to time about the cosmos and universe (Pudritz, *et al*., 2007). In the present study the basic blocks for

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existence of things living or non living were evaluated from two perspectives: one to emphasize the number of basic blocks and the other to elucidate the interplay of the basic blocks for the formation of various objects.

Methodology

The literature of Unani medicine regarding basic blocks (*Arkan*) was thoroughly surveyed. Various books regarding the philosophical interpretation regarding the formation of universe, objects and organization of life were also studied. It was attempted to see the perspective of Unani medicine regarding nature of things and how *Arkan Arba* theory became tenable. Moreover, present perspective was correlated with the inferences derived from the *Arkan Arba* theory.

Theory of *Arkan*

Many theories regarding the origin and existence of universe and life had been proposed. The theory of *Arkān* was suggested by ancient Greek philosophers. One of them projected that only *Mā*' (water) is responsible for origin of everything; this theory was proposed by Thales (640-546BC) and Hippon (Zhmud, 2006; Russel, 1945; Furley, 1987; Said, 1975). Thales said that the earth floats on water indicating that alimentation of everything is moistness and warmth. It was supported by the argument that all seeds have the moist temperament; while water is the principle source of moistness (Furley, 1987). Few scholars have implied Thales view by saying that the water is starting point (arch) of whole universe and it continued to exist all the way through the life of the universe; hence, it may be reasonable to say that everything of this planet is basically water (Zhmud, 2006; Furley, 1987). Diogenes states that air is eternal thing which is common to origin of all creatures. It means it can penetrate everywhere and guide the whole thing and set out everything (Furley, 1987). Anaximenes specified that basic *Rukn* (constituent) is *Hawā*' (air), taken however in a wider meaning than the blend of gases that we breathe. For him it was a medium that holds the whole universe together. It has different densities, which explain different forms in which matter exists. His speculative reasoning was a step toward establishment of physics (Teerikorpi *et al*., 2009; Furley, 1987). Further he explained fire is a rarefied air, while air condenses and becomes water, next earth and ultimately stone. This theory suggests that differences between different substances exclusively depend upon the degree of condensation. He justified the idea by stating that entire earth is surrounded by air. *"Just as our soul, being air holds us together so do breath and air encompasses the whole world"*. It appears that the whole universe breathes (Ahmad, 1983; Russel, 1945). Further he thought that *Hawā*' (air) controls the cosmos and clutches it together as the psyche controls the body (Jaeger, 1936). Likewise, Pherecydes (600-550BC) holds the thought about *Arz* (Earth) (Ahmad, 2009) and according to Heraclitus

(540-475BC) and Hippasus (Zhmud, 2006) *Nār* (fire) was the basic constituent by which the world was made. Even *Nār* (fire) is apparently not a matter just as the *Mā'* (water) and *Hawā'* (air) are, because it does not have definite physical dimension and naturally it transforms into other thing, rather than acquiring different properties itself. In one facet it extirpates; green forest full of wild life; on other way heat as a cause of life like the warmth of the sun brings growth into new life in the spring and the warmth of the body is at least a necessary condition of life in animals. But the fire has not been attributed to transform from the living to the dead or vice versa (Furley, 1987). Heraclitus doctrine shows *"All things are an exchange for fire, and fire for all things, even as wares for gold and gold for wares". "Fire lives the death of air and air lives the death of fire, water lives the death of earth, earth that of water"* (Russel, 1945). He thinks that fire is the system where material changes are brought about and maintained by the application of heat. Likewise, Milesians suggested that moisture and breath are the material basis of life. Hence Heraclitus beseeches to the upholding cause of process of life. A specific amount of heat keeps the process of growth and genesis sustaining (Furley, 1987).

The change of climate is an evident paradigm for the sequential expansion, decomposition and then new development. Although at any time the fire must not be entirely extinguished or too dynamically fire up; both extreme warmth and extreme cold carry the life to the finish (Furley, 1987).

More than one component theories

Two components (*Ar* and *Mā'*) theory set forth by renowned philosopher Xenophanes (570-470 BC) (Jalinoos, 2008; Draper, 2010). Anaximander (546 BC) was the second philosopher of the Milesion School. He stated that all things have originated from single primal constituent but it is not water as Thales held or any other substance that we know. It is boundless, endless and unchanging, and *"It encompasses all the worlds"*- inference to this our globe is only one of numerous. The primal constituent is metamorphosed into several constituents with whom we are easily recognized, and these are metamorphosed into one another (Russel, 1945). Thereafter some of the philosophers thought that two *Arkān* theory was inappropriate, so the concept of three *Arkān* emerged. This theory advocates that the matters are in three states i.e. *Rukn Jamidah* (solid), *Rukn Maiyah* (liquid) and *Rukn Hawā'iyah* (gaseous) (Ahmad, 1983).

Parmenides of Elea (540-470 BC) assumed that everything is composed of two primary constituents, of which one conforms to being and the other not being (Feller, 1958). Anaxagoras of Clazomenx (500-428 BC) concurred with Empedocles where he said that each and every thing comes into being in the form of *Tarkīb* (composition) and ceases to be separation of already existing matters, and that the qualitative modification is based on the alteration of composition of

substances (Feller, 1958). Finally, Empedocles (6th century BC) proposed the concept of *Arkan Arba* (*Nar, Hawa, Ma, Ard*) (Osaibah, 1990; Leary, 1949) which corresponds to four forms of matters i.e. *Jamid* (solid), *Saiy'āl* (liquid), *Hawā'i* (gas) and *Khilt-e- Mai* (plasma) in right way (Anonymous, 1973; Russel, 1945; Said, 1975; Teerikorpi *et al*., 2009; Hajar, 1991; Magner, 2005). He states *"Four roots of the all"*. These might be mixed in different proportion, and thus produce the varying composite that we observe on the earth (Russel, 1945, Stelmack *et al*., 1991). They are empowered by two moving forces of action and reaction "tying and untying forces" i.e. Philia and Neikos (love and strife). These forces are essential for mixing and taking part of any stuff to bestow with amalgamation and decomposition. There is a phase, where primary constituents have been mixed thoroughly by Philia, and Neikos, it can cause parting them out again slowly. Hence, every composite of this universe is temporary (Russel, 1945; Teerikorpi, *et al*., 2009; Jaeger, 1936; Stelmack, *et al*., 1991; Bertolacci, 2006).

Pythagoras (6th century BC) agreed with the concept of *Arkān Arba* that was perceived by Empedocles by which everything of this universe cropped up. (www.mysecurepayment.com/essays/Pre-socratic-cosmology.html/ 2014)

Impressed by the theory of *Arkān Arba*, Hippocrates (460-361BC) put forward the theory of *Akhlāt* (humors) (Chandpuri, 1998). Hippocrates states that disease is not a localized pattern, but a disorder affecting the whole body through some disproportion in the four humors viz. *Dam* (blood), *Balgham* (phlegm), *Safrā* (yellow bile) and *Sawdā* (black bile). The microcosm of the human body contains four humors and four associated qualities i.e. hot, cold, moist and dry corresponding to four basic constituents (*Nar, Hawa, Ma* and *Ard*) that form the macrocosm (Magner, 2005).

After Hippocrates, Plato (429-347BC) was also convinced with the doctrine of Empedocles. He said that these are in fixed ratio i.e. "Fire is to air as air is to water and as water is to earth". Nature brought to play the four constituents in making the universe, and hence, it is complete, and not accountable to old age or malady (Russel, 1945). In view of the above principles Plato theorized that *"The diverse forms of soil have been derived through Mā' (water), converted into shape of weighty Hawā' (air) and then compressed to solid that it no further dissolves in water. The equal and homogenous (cubic) part makes the finer and transparent stones"*. Further for attaining state of perfection of inorganic material a special type of force is necessary that leads the formation and unity of inorganic matter to achieve its perfect state (Hurle, 1993).

It was believed in Plato academy that five forms of primary constituents i.e. *Nār* (fire), *Ar* (earth), *Hawā'* (air), *Mā'* (water) and celestial matter were supposed to be Ajza-eAwwaliyah (Teerikorpi *et al*., 2009). Aristotle (384-322BC) said that the amalgamation of primary constituents is the cause of natural world evolution (Russel, 1945).

Interplay of *Arkan* - The Dynamic Flux

The physical objects are made up of different components which are arranged in harmonized or uniform combination that are themselves comprised of the four primary constituents (Wood *et al*., 2004). Some bodies are susceptible to *Kaun o Fasād* (generation and destruction), while others are not and instead exist as a result of a temporal creation. If that is the case, then there is no common substance in the first of the two, since there is no single substance that is sometimes susceptible to the form of what undergoes generation and destruction and at another time is vulnerable to the form of what is naturally imperishable and has no material genesis. Therefore it is not possible, however, it might be possible that the class of bodies subjected to *Kaun o Fasād* (generation and destruction) has a substance that is common to those that are generated out of and destroyed into one another, as can be seen in the case of the *Arkan Arba* (four basic constituents) (Mc Ginnis, 2009).

Aristotle states that *Ard* (earth) and heavens are entirely diverse in nature. The *Ard* and everything on and above it, up as far as the moon, were held to be subject to vary, decompose and flawed. Everything here is composed of the amalgamation of *Arkan Arba* and all natural movement on the earth is basically in a straight line, either straight up like *Nār* (fire) and *Hawā'* (air), or straight down like *Mā'* (water) and *Ar* (earth) (Ladyman, 2002). He also delineated that four primary properties of all substances are opposite to each other. *Burudat* (cold) and *Yabusat* (dryness) are contrary to *Hararat* and *Rutubat*. On the basis of metamorphosis the concept of transmuting agent came into surface over the hundred years. This encourages the transformation of one kind of material into another (Hurle, 1993). He further said that bodies are likely to fall into one point that is center of the *Ard*. He realized that *Ard* is like a ball and that its center is also the central point of the universe. Aristotle justified that only a finite universe could have a Markaz (center). Aristotle concurred with Empedocles that *"down here"* there are four *Arkān*, one of which is the *Jamid madda* (solid material) of which the earth is made. It was an essential part of Aristotelian dynamics that motions of bodies are governed by their striving toward their *natural place*. The normal place of *Rukn Ar* (earth) is the center of the universe, so the normal movement is toward *downward*. The movement of the *Nar* is towards *"up"* which is opposite to the earth. In the same way *Maá* and *Hawa* had their inclination to settle in different stratum (Teerikorpi *et al*., 2009).

Some of the predecessors of Aristotle had a different view in context of mixture and its separation. They said substances are composed by different proportions of four primary constituents. If these are in right proportion of mixture a substance is produced otherwise substance is destructed (Stone, 1999). The alteration occurs on the basis of changes in qualities not driven by the mixture

of *Arkan Arba* because they remain unchanged. Ibn Sina also corroborated the concept of Aristotle (Mc Ginnis, 2009; Stone, 1999; Maier, 1955). Aristotle asserted that Arkan Arba are distinct types of sensible matters, and that they can be metamorphosed completely one into the other. The substrate in which metamorphosis takes place is the physical substance common to *Arkan Arba*. This substance might be a prime substance in the physical sense, because all other corporeal substances are mixture of *Arkan Arba*. The substances which are common to these four must be common to every corporeal thing, and so remain invariable through all corporeal alterations. Still it might be metaphysical primary substance (Stone, 1999).

Description of Four *Arkan*

Earth is a simple body; its natural position is in the centre of other *Arkān* due to its gravity (Nafis, YNM; Anonymous, 1993; Anonymous, 1973). In that position, it remains stationary by virtue of its nature, but when it is displaced it returns to its original position. This is the explanation for its absolute heaviness. Earth is by nature cold and dry (Anonymous 1993; Kant, 2008) and serves the purpose of making the objects firm and stable, and maintains their forms and figures (Anonymous, 1993; Antaki, 2008),

Water is a simple body which, in its natural position, surrounds the earth while it itself is surrounded by the air provided that both of them are in their natural position. This is the explanation for heaviness of water which (Anonymous, 1993) is cold and moist in nature. It is naturally cold therefore it acquires its natural property even if it is warmed (Nafis, YNM) (Jurjani, 2010; Ibn Sina, 2010; Antaki, 2008; Arzani, 2010). The warmness indicates the presence of fire in the body. Fire is dry and hot in nature, due to its dryness it hardly occupies any shape (Israili, YNM). Fire is a *Jism-e-Baseet* (simple body) that is subtle and light in nature (Baghdadi, 2004). Fire is an inanimate and uniform matter, it raise higher than other constituents, owing to its absolute lightness. The fire intermixes with everything on account of being light and having imbibed heat. The power of fire also causes the penetration of air everywhere in the bodies even it disintegrates the extremeness of *Mā'* and *Ar* (Baghdadi, 2004, Jurjani, 2010; Ibn Sina, 2010; Arzani, 2010; Ahmad, 1983).

Hawā' (Air) is a simple body; its natural position is above *'Mā'* (water) and below the *Nār* (fire) (Anonymous, 1973). The nature of *Hawā'* (Air) is *Har Ratab* (hot and moist) (Baghdadi, 2004). Air is not *Barid* (cold) because a barid substance becomes heavy and dense since, as *Burūdat* is the cause of heaviness and density (Israili., YNM). Air stands for *Latafat* (lightness), *Takhalkhul* (porosity), *Tause'e* (expansion) (Jurjani, 2010; Ibn Sina, 2010; Arzani, 2010).

All the four qualities of *Arkān Arba´ a* play key role in the formation of natural substances, for instance, *Kafiyāt Har* causes heating, disintegration, evaporation and annihilation. *Burūdat* (coldness) stands for cooling, compaction and freezing whereas, *Rutūbat* (moistness) stands for soften, greasy and fluidization and *Yubūsat* (dryness) as denseness, firmness and protection (Israili, YNM).

In the light of the description of Unani philosophers the physical properties and phases of *Arkān Arba´a* (four basic constituents) can be interpreted easily by contemporary physical sciences which state that physical state of a sample of physical matter and its physical condition is determined by its physical properties. Two samples of a matter that have similar physical properties will always be same in nature (Atkins, *et al*., 2010).

In the Latin West, Ibn Sina and Ibn Rushd were known as the principal adversaries on a much-discussed question of element theory, especially in the fourteenth century. Given that if all physical substances (apart from the elements themselves) are mixtures of *Arkān Arba´a* (four basic constituents), the question then arises that how do the elements exist in them? Ibn Sina's answer is simple that substantial form of the elements remains unaltered when a compound is formed; only the qualities of the elements are altered and unite to a mean of quality, or complexion (Gutas, 2012; Magner, 2005; Mc Ginnis, 2009).

Present Perspective

Atomism of Dalton leads to the understanding of basic blocks as atoms of different physical and chemical properties. This progressed to the acceptance of number of distinct element that have composed all the substances in the world. The principle of organization and special configuration however remains intact. Since the advent of particle physics only organization and configuration have retained permanency whereas the very nature of elements has shifted to localized energy packets. It seems right time to view the same with new enlightened revision to the theory of existence of matter as stated by ancient philosophers.

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Hypertension in Unani System of Medicine

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Abstract

Unani scholars were all mindful of Zaght-e-damwi (blood pressure). They viewed Zaghta-e-Inqabazi as Systole and Zaghta-e-Inbesati as Diastole. The organs of dissemination have been portrayed by Ibn Nafees (1208-1289). The term hypertension or *Zaghtuddam Qawi* has not been used as such in any of the established Unani writings. Rather Unani physicians have described hypertension as *Imtila Ba Hasbil Auiya* and said this happens because of sue-e-mizaj damwi. They were aware of the hypertension, as they have discussed it in terms of giving a detailed account of its related symptoms such as migraine, palpitation, vertigo and epistaxis etc. Few of them described expanded blood volume in lumen of veins as the cause of hypertension. They further described that hypertension is an appearance of yabusat-e-mizaj (dryness of temperament) which is the primary cause of atherosclerosis (Tasallub-e-Sharaeen). Imtila has been mentioned as one of the reasons for *khafqan* (palpitation) and other disorders. Thus Imtila appears to be a correlate of hypertension. Later on Unani physicians coined the term *Zaghtuddam Qawi* for hypertension. Unani scholars appear to give vivid description of the circulatory disease determinants including hypertension however they were unable to assimilate their depictions to designate the malady. Imtila has been attributed to be associated with migraine, congested eyes, pulsatile conduits, puffiness of face, heavy head, anxiety, yawning, epistaxis, torpidity, flushing of face, warm body with no outside cause and ejections etc which are the symptoms and indicators of hypertension. The principle of treatment has been established by Unani physicians in the light of its physiopathology and the clinical features. There appears to be a great degree of similarity in Unani and that of modern concept of hypertension.

Key words: Zaghta-e-damwi, Hypertension, Zaghtuddam Qawi, Unani Medicine

Introduction

The term hypertension was first used by Harry Gold Ballet in 1934. However the Unani scholars (mainly Razi and, Majoosi) were well aware of the disease and its symptomatic manifestation although they did not give it a specific name. Rather they described it under a broad term of Imtila. They described symptoms such as headache, vertigo and epistaxis etc. of Imtila and explained it as vascular pressure caused by increase in blood volume and decrease in the lumen of blood vessels. Some of the scholars have also attributed hypertension to develop because of yabusat-e-urooq (Dryness of arteries). After Razi other Unani physicians including Majoosi, Ibn Sina, Ibn Rushd and Jurjani have also described and agreed with the Razi's description.

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As per Unani description Imtila is of following two types (Kabeeruddin, 1916; Ahmad, 1980):

(i) Imtila Ba Hasbil Auiya (repletion with respect to the vessels)

(ii) Imtila Ba Hasbil Quwa (repletion with respect to the vitality)

Imtila Ba Hasbul Auiya

Imtila-Ba-Hasbil Auyia indicates that the quality of humours is normal but the quantity has increased so much that the blood vessels have filled up overly and distended. It is an increase in blood volume leading to increased vascular pressure. Unani physicians have also attributed decrease in the lumen of blood vessels as a cause for increased vascular pressure. They have described heaviness of head and visual disturbances as the symptoms of Imtila and rupture of blood vessels in the form of epistaxis, hemoptysis and hemorrhage as its complications. Patients of Imtila with hemorrhagic tendency are advised timely venesection to decrease the blood volume and prevent the chances of hemorrhage which may result in sudden death. Light diet and rest is also advised to such patients.

Jalinoos (Galen) recommended venesection (fasad) for those patients who have symptoms like anxiety, excessive sleep and visualization of red objects in dream during sleep. The incidence of decreased lumen of blood vessels has also been mentioned by Ibn Rushd. He has described that callose (kaimoos) gets accumulated in blood in excess amount resulting in increased pressure and repletion of blood and ruh, causing general repletion of body. This type of Imtila is described to cause suda (headache), Imtela-e-chashm (eye congestion), puffiness of face, pulsatile arteries, dark coloured turbid urine, heaviness in head, restlessness, yawning, ruaaf (epistaxis), flushing of face, warm body. Ibn Sina has described this type of Imtila arise either due to strong retentive faculties (quwwat-e-masika) or weak expulsive faculties (quwwat-e-dafia). According to Ibn Sina and Majoosi, inordinate intake of food, consumption of alcohol, sedentary life and lack of exercise result in accumulation of waste products in our body leading to development of Imtila. It is usually seen in obese persons. Jalinoos recommended venesection (fasad) for those patients who have symptoms like anxiety, excessive sleep and observing red object in dream during sleep (Kabeeruddin, 1916; Ahmad, 1980; Razi, 1991; Kantoori, 1889).

Imtela Ba Hasbil Quwa

Imtila-ba-hasbil quwa is also called Imtila-ba-hasbul-kaifiat. In this type of Imtila along with redundant humours their quality is also affected. Morbid humours control the vitality of the body with their morbid nature and do not allow the normal processes of digestion and metabolism to be operated efficiently. Person

suffering from Imtila-ba-hasbil quwa are more prone to infectious disease (Shah, 2007; Kabeeruddin, 1930; Kantoori, 1896). It means that the resistance of the body becomes so weak that even small amount of morbid matter may produce toxicity. One feels heaviness and dullness in spite of absence of any apparent cause for the same. According to Majoosi, it occurs as a result of weakness of tabiyat due to which, food is not properly digested and morbid matters are formed causing heaviness and tiredness (Ahmad, 1980; Kabeeruddin, 1930).

Redundant intake of food and alcohol, physical inactivity and repose lead to accumulation of metabolic products which culminates into Imtila. It has also been described that Imtila is more prevalent in people with lean and asthenic built as their rate of absorption of metabolic products is more than their resolution.

Ibn Sina has described Imtila Ba Hasbil Auiya as quantitative enhancement of humours that over fills the vessels and causes their distension. He has also described it grievous as the blood vessels may rupture and humours may flow towards blocked passages resulting in the development of symptoms manifesting diphtheria, epilepsy and apoplexy etc like condition. He advocated venesection for such a condition. In Imtila Ba Hasbil Quwa both the quantity of humours and their morbid state cause the pathological condition. Such humours take the control of vitality of the body and affect the normal functioning of the body. A person suffering from this condition is at high risk of putrefactive diseases (Kantoori, 1896; Israeeli, 1907; Khan, 2004).

According to Ibn Rushd the increased volume of' intracellular fluid causes a state of Imtila. When it is associated with some degree of derangement in the temperament, it is called Imtela-Ba-Hasbul Quwa. A deviation in the temperament of blood is again a cause of Imtila. He has described signs and symptoms of this condition which are similar to those described by other Unani scholars. According to Razi in this type of Imtila, tabiyat becomes unable to do its work due to excess of blood. Quwwate ghaziya absorbs nutrients from the blood but Tabiyat fails to make it a part of the body and therefore leading to this type of repletion (Razi, 1991; Ibn Rushd, 1980).

Yabusat-e-Urooq (Dryness of arteries)

Blood pressure is inversely proportional to the power of radius of vessels, so a slight decrease in lumen of arteriole causes major change in blood pressure and the increase in the peripheral resistance directly increases the blood pressure. A number of factors have been described to be responsible for decrease in the lumen and increase in the peripheral resistance. Hypertension is more prevalent in elderly (>60 yrs) because of yabusat-e-urooq (Dryness of arteries) which has been described to be more prevalent in elderly people (Kausar, 1984). Razi described yabusat (dryness), Khilqi Tazaiyuq e-Shiryani (Congenital narrowing

of arteries) and Hararat (Temperature) as the causes of rapid pulse. Ibn Rushd says that the dryness is a factor for narrowing of blood vessels. The diameters of blood vessels in different temperaments are described to be Hot-wet > Hot-dry > cold-dry.

Ibn Nafis (1438 A.D) has discussed that Nabze-Sulb (Rigid pulse) is produced due to yabusat (dryness). In obese persons, the lumen of arteries is smaller and heart rate is faster (Ibn-e-Rushd, 1980). The prevalence of hypertension is greater in obese people due to inordinate adipose tissue and increased dryness.

Basheezak

It is a term described by Razi in Al-Hawi (Razi, 1997). The symptomatic manifestation of Basheezak is redness of eyes and tension in blood vessels, which reflect hypertension. He has described the management of Basheezak as deep sleep, fasad (Venesection) and use of Mushilat-e-Safra drugs (Purgatives of yellow bile). This term appears to denote a peculiar type of hypertensive state which may be useful in clinical practice though any correlate of this terminology has not been described in conventional medicine.

Determinants/ Risk Factors

Consistency of blood (qiwamuddam) makes the fringe resistance along these lines the circulatory strain is kept up which results proficient flow of blood. Ibn Abbas said that the qiwamuddam of the venous blood is higher than the blood vessel due to weight pressure of Bukharat-e-dukhania (CO_2) in the blood (Kantoori, 1889). Whether pulse is high, low or normal it relies upon a few variables i.e. the yield from the heart, the resistance of the blood stream to the blood vessels or the volume of blood and blood circulation to different organs. These are brought about by the impingement of the six essential components of health.

Etiology

Majoosi is of the view that Imtila is brought about by over the top intake of nourishment and liquor and lack of physical exercise and evasion from hammam (wet and steam shower). Natural components embroiled in the causation of hypertension include umoor-e-nafsania (push, outrage and nervousness etc), corpulence and derangement of temperament.

Pathophysiology

As indicated above, because of a state of abnormality in veins; their constriction and unwinding Imtila may develop. It has been further argued that Muhraraq Sauda prompts to yabusat, which in turn causes salabat (solidness) in vessels, causing their constriction and unwinding. In case the sauda is rotted, it will increase in amount and will create more solidness because sauda is assigned

to possess relatively more yabusat (Khan, 2004). Quwate Masika (retentive power) responsible mainly to constrict the vessels is intervened with burudat and yabusat (Israeeli, 1907). The reason of narrowing and shutting of waterways and pathway have been described to be due to the predominance of the Yabis Mizaj of the body. In case Su'e Mizaj Yabis prevails over the body, it may solidify the vessels. Shutting of waterway is either because of increased Quwate Masika or decreased Quwate Dafia (expulsive power). Afaale-nafsania, for example, outrage, uneasiness, pressure etc are the manifestations of hararat and yabusat (Kantoori, 1896). In nabz-e-sulb (hardn pulse), salabat (sclerosis) in the nabz is found because of dryness. Thus the blood vessel firmness predisposes the hypertension, as it diminishes the limit of withdrawal and unwinding. Increment in burudat, yabusat and quwate masika brings about the blood vessel firmness. An increase in muhtaraq or putrified auda because of any reason induces yabusat. Tabri has mentioned that Mizaj of vessels in ordinary condition remains Ratab. However, in hypertension it is found strayed from Ratab to Yabis and contributes significantly to give rise to hypertension.

Clinical Features

A comparison of clinical features of Imtila and hypertension indicates that the symptoms described in respect of the two are almost similar. The comparison has been summarized in the table given below:

Symptoms	Hypertension	Imtila
Headache	+	+
Palpitation	+	+
Dizziness	+	+
Breathlessness	+	+
Fatigability	+	+
Epistaxis	+	+
Blurring of Vision	+	+
Redness of face	+	+
Confusion	+	+
Chest pain	+	–
Diaphoresis	+	–
Fullness of pulse	+	+
Weakness	–	–
Hot touch of skin	–	+
Loss of appetite	–	+
Yawning	–	+
Constrained speech	–	+
Nightmares	–	–

It is evident from the description mentioned in Unani literature that hypertension is a damvi (sanguine) disease. The sign and symptoms of Hypertension can be compared with the sign and symptoms of imtela-e-urooq and yaboosat-e-urooq (Fullness and Dryness of arteries). Classical Unani physicians were well aware of the manifestations of imtila-e-urooq and its management, though they have not mentioned the term hypertension as such. Rather some of the physicians especially Razi and Ibn Sina have described a new term Basheezak for raised blood pressure mainly caused by narrowing of blood vessels (Imtila Ba Hasbul Auiya) (Ibn Rushd, 1980; Razi, 1997; Tabri, YNM; Ibn Sina, 1930; Jurjani, 1903; Mehta, 1998; Golwala & Golwala, 1992; Kumar & Clark, 2009; Ansari, 1930)

Management

The term hypertension is not mentioned as such in classical Unani literature but clinical features representing hypertension have been mentioned under Imtila Ba Hasbul Auiya.

As per Unani concept the principle of management is to reduce Imtila by decreasing the blood volume. This principle can be achieved by giving non-pharmacological regimen as well as pharmacological interventions. A number of drugs have been mentioned in the treatment of hypertension which contributes to alleviate the symptoms in many ways like mufatihaat (vasodilators), munawimmat (hypnotics), musakkinat (relaxant) and mudirrat (diuretics) etc (Kabeeruddin, 1916; Kantoori, 1889; Ahmad, 1983).

Line of Treatment

Ilaj Bil-Ghiza (Dietotheraphy)

Ilaj Bil-Tadbeer (Non-pharmacological therapy)

Ilaj Bil-Dawa (Pharmacotherapy)

Ilaj Bil-Ghiza (Dietotheraphy)

There is a vivid description of dietary recommendations in Unani medicine for the patients of hypertension. The group of dietary supplements that control common risk factors such as hyperlipidaemia, atherosclerosis and anxiety are commonly recommended for improving the state of hypertension and its complications. There is a large list of dietary substances which are considered to be anti-hyperlipidemic, anxiolytic and exhilarants.

Lehsun (*Allium sativum*); Pyaaz (*Allium cepa*); Zeera siyah (*Carum carvii*), Anannas (*Annanas sativus*), Seb (*Malus sylvestris*), Kadu (*Cucurbita moschata*), Gajar (*Daucus carota*), Khubani (*Prunus armeniaca*), Tarbooz (*Citrulus vulgaris*), Anar (*Punica granatum*), Kharpaza (*Cucumis melo*), Toot (*Morus indica*), Pista (*Pistacia vera*) are some of the dietary substances that are useful to manage Imtila or hypertension (Razi, 1991; Tabri, YNM; Ibn Sina, 1903; Khan, 1286H).

Ilaj-Bil Tadbeer (Non-Pharmacological therapy)

Ilaj Bil Tadbeer involves the modification of Asbab-e-Sitta Zarooria (six essentials of healthy living). It is very helpful in prevention as well as control of high blood pressure. A significant diminution of risk factors has been observed after strictly following the regimens of maintaining Asbab-e-Sitta Zarooria including adequate sleep, increase in physical work, stress free life etc. Following are some regimenal therapies prescribed by Unani scholars in the management of high blood pressure (Razi, 1991; Tabri, YNM; Ibn Sina, 1930):

Fasad (Venesection)

Tareeq (Diaphoresis)

Ishaal (Purgation)

Taleeq (Leeching)

Ilaj Bil-Dawa (Pharmacotherapy)

Looking at various aspects of high blood pressure, several single drugs and compound Unani formulations have been describe which are in use since centuries for successful management of hypertension (Kabeeruddin, 1916; Ahmad, 1980; Kantoori, 1889; Ahmad, 1983). These are as follows:

Munawimmat (Hypnotics)

- Akseer-e-Shifa
- Roghan-e-laboob Saba
- Tukhm-e-Khashkhas (seeds of *Papaver sominiferum* Linn)
- Roghan-e-Khashkhash (oil of *Papaver sominiferum* Linn)

Mubarridat (Refrigerants)

- Kishneez (*Coriandrum sativum* Linn)
- Gul-e-Neelofar (*Nymhaea lotus*)
- Tukhm-c-Kahu (*Lactuca sativa*)
- Tukhm-e-Khurfa (*Portutaca oleracea* Linn)

Mufattihat (Vasodilators/deobstruent)

- Arjun chaal (*Terminalia Arjuna* Linn.)
- Lahsun (*Alium sativum* linn.)

Musakkinat (Relaxants)

- Sankhahuli (*Convolvulus pluricaulis* Choisy)
- Asrol (*Rauwolfia serpentina*)

Tukhm-e-Kahu (*Lactuca sativa* Linn)

Gul-e-Neelofar (*Nymhaea lotus* Hook F. & Thumb)

Mufarrehaat (Diuretics)

Sandal Safaid (*Santalam album*)

Parsiyoshan (*Adiantum capillus veneris* Linn)

Abresham (*Silk coccon*)

Khas (*Andropogon muricatus* linn)

Mudirrat (Diuretics)

Sharbat Bazoori Mautidil

Habb-e-Mudir

Tukhm-e-Kharpaza (*Cucumis melo* Linn.)

Tukhm-e-Khayarien (*Cucumis sativus* L.)

Conclusion

Hypertension as such has not been described as such in Unani medicine however the disease and its attributes including its clinical features, symptoms and management etc were known to Unani physicians. It has been mainly described in terms of Imtila and has been characterized to be a Damwi disorder. Its three important attributes are increased blood volume, expanded volume consistency and thickening and solidifying of vessels (arteriosclerosis). These are almost similar to that described in conventional medicine in respect of hypertension. Similarly, the principle of treatment with minor divergence also appears to be same. Some of the attributes such as Basheezak and a number of drugs used in Unani medicine to control hypertension must be looked in to afresh to find out a degree of consonance if any between two. This may exposed a new frontier for research as well.

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Anisoon (*Pimpinella anisum* L.): A review of Pharmacological Activities and Clinical Effects

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Abstract

Unani drug Anisoon, the seeds of a plant *Pimpinella anisum* Linn, is one of the oldest spices and important medicinal herb mentioned by Greek and Roman Unani physicians in their treatises for its diverse therapeutic properties centuries ago. It is one of the most ancient crops cultivated in the eastern Mediterranean Region, Western Asia, the Middle East, Mexico, Egypt, and Spain. In Unani system of medicine, it is used as Kasir-e-riyah, Mohallil-e-Riyah, Muqawwi-e-Meda, Mushtahi, Mufatteh, Mufatteh Sudad, Munaffis-e-Balgham, Mukhrij-e-Balgham, Muddir-e-Bol, while in ethno-medical literature it has been described to be mild expectorant, stimulant, carminative, diuretic, and diaphoretic showing that the plant has diverse biological and pharmacological activities. Keeping in view its high medicinal importance in Unani medicine, a comprehensive review based on Unani, ethnobotanical, phytochemical and pharmacological literature has been presented with an aim to expose new frontiers for research and therapeutic application of anisoon.

Keywords: *Pimpinella anisum*, Anisoon, Unani Medicine, Mudir-e-Bol, Mufatteh Sudad, Kasir-e-riyah

Introduction

Medicinal plants have played an important role in the treatment of diseases all over the world. Unani system of medicine (USM) is a rich source of medicinal herbs, used from centauries (Parray *et al*., 2012). The versatility and richness of USM is due to interaction of various pathies, where Unani physicians and scholars have not only included the drugs from other traditional medicines but have undertaken experimental works to prepare the profile for their medicinal effects and therapeutic uses (Mobeen *et al*., 2017). Anisoon (*Pimpinella anisum* Linn) is one such herb used from centauries in USM for different pharmacological effect.

It is one of the oldest spices and an important medicinal herb (Shobha, 2013). Greek and Roman physicians have mentioned its therapeutic uses in their treatises centuries ago. Theophrastus, Dioscorides and Pliny have described its use in their books 2000 years ago (Evans, 2002) and its medicinal activities have been described in Unani, Ayurveda, British Pharmacopoea and WHO monograph which is mainly attributed to its essential oil (Jamshidzadeh, *et al*, 2015). Anisoon is primarily grown for its fruits that are harvested in August and September. It belongs to the Umbelliferae family.

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Habitat

Aniseed is indigenous to Egypt, Greece and Western Asia. It is cultivated in Eastern Mediterranean region, Middle East (Shojaii *et al*, 2012), Russia, France, Spain, Italy, Bulgaria, Mexico, India (Kokate *et al*, 2007), North Africa, Central Europe (Anonymous, 2005), Southern Europe, Turkey, Central Asia, China, Japan, Central and South America (Anonymous, 2000). In India it is cultivated in Madhya Pradesh (Khare, 2004), Uttar Pradesh, Punjab and Orissa (Kokate *et al*, 2007). Spain and Egypt are the principal producers of its oil (Evans, 2002). A large quantity of aniseed is said to be exported from India and also imported, exports are mainly made to Afghanistan and Pakistan and imports are mainly from Malaysia, Vietnam and Taiwan (Anonymous, 2005).

Cultivation

Pimpinella anisum is primarily grown for its seeds (aniseeds). It is harvested in August and September. The plant prefers a light, fertile or moderately rich, well-drained sandy loam and is propagated by seeds. Plant is cultivated from middle of October to the end of November in plain areas, and from the beginning of April to the end of May in hilly areas. About 13 kg of seeds are sufficient to plant a hectare of land. The crop is ready for harvesting in 3.5 months after planting when the tips of the seeds turn greyish green. Under favourable conditions, a yield of 445-665 kg of fruit per hectare may be expected (Anonymous, 2005).

Botanical Name: *Pimpinella anisum* (Nadkarni, 2007; Khare, 2004; Tariq, 2010)

Family: Umbelliferae, Apiaceae, (Anonymous, 2005; Nadkarni, 2007)

Vernaculars

Arabic: Anisun (Nadkarni, 2007) Bazrul Razyanaj Roomi (Ramlubhaya, 2004; Ibn Baitar, YNM, Anonymous, 2007), Razyanje Shami, Habul Hulu, Kamoon Hulu (Noor Karim, YNM; Ibn Baitar, YNM; Anonymous, 2007), Persian: Badian (Nadkarni, 2007), Badiyan Roomi, Zeera Roomi (Kareem, YNM; Ghani, 2011; Ibn Baitar, YNM; Anonymous, 2007), Unani: Anisoon, Badiyaan-roomi (Khare, 2004; Kabiruddin, YNM; Anonymous, 2007), Aanis, Omariqa (Ibn Baitar, YNM). English: Anise, Aniseeds, Spanish Aniseeds (Khare, 2004), Sweet Fennel (Nadkarni, 2007), Aniseed (Ibn Baitar, YNM), Anisi (Tariq, 2010), France: Anis. (Nadkarni, 2007), German: Anis-Biberrell (Nadkarni, 2007), Hindi: Saunf, Sawolf, Badian (Prajapati *et al*, 2003), Saurif (Nadkarni, 2007), Sanskrit: Shatapushpa, Madhurimisi, Karavee, Shatava, Shetpushpa (Nadkarni, 2007), Nepal: Sop (Anonymous, 2005), Bengali: Muhuri, Mitha jira (Prajapati *et al*, 2003), Mori (Kabiruddin, YNM; Tariq, 2010), Gujrati: Anisa (Prajapati *et al*, 2003), Kannad: Shomba (Prajapati *et al*, 2003), Marathi: Somp, badishep (Anonymous, 2005; Anonymous, 2007), Oriya: Sop (Anonymous, 2005), Sindhi: Saunf Roomi

(Kabiruddin, YNM; Tariq, 2010), Tamil: Shomba (Prajapati *et al*, 2003), Telgu: Kuppi,sopu (Prajapati *et al*, 2003; Anonymous, 2007),

Botanical Description

Macroscopic characteristics

The fruit (schizocarp or cremocarp) ovoid or pyriform, laterally compressed, 3-5 mm in length and 2-3 mm broad, grayish green to grayish brown, mericarp broadly ovoid, 5-ridged with short hairs and numerous vittae (Anonymous, 2005). The seed have a sweet taste and a characteristic odour and aromatic; the aroma is more when crushed. Seeds are rough to touch; primary ridges are slender, pale and uniform in width short bifurcate stylopod at the apex (Kokate *et al*, 2007). The flowers are small, white, in compound umbles (Anonymous, 2005). The inflorescences are medium sized umbels with about 7 to 15 scattered pubescent rays. There is usually no involucre, but sometimes there is a single bract. There are barely any sepals. The petals are white, about 15 mm long, and have a ciliate margin. They have small bristles on the outside and a long indented tip (Anonymous, 2000). The root is thin and fusiform, and the stem is erect, round, grooved and branched above (Anonymous, 2000). The leaves are pinnatifid or terminately pinnate (Anonymous, 2005; Anonymous, 2007). The lower leaves are petiolate, orbicular-reniform, entire and coarsely dentate to lobed. The middle leaves are orbicular and 3-lobed, or 3-segmented with ovate or obovate segments. The upper leaves are short petioled to sessile with narrow sheaths; they are pinnatisect with narrow tips (Anonymous, 2000).

Microscopic Study of Seed

Under the microscope, transverse section of anise show an epidermal layer bears numerous papillae and unicellular hairs (Evans, 2002). The epidermis of fruits is covered by numerous, unicellular conical thick walled warty trichomes (Kokate *et al*., 2007). On the dorsal surface of each mericarp are from 15-45 branched vittae (Evans, 2002), while two large vittae are seen on commissural surface (Kokate *et al*., 2007). An endosperm is slightly concave on the commissural surface and contains protein and fixed oil (Evans, 2002), small aleurone grains, rosette crystals of calcium oxalate (Kokate *et al*., 2007).

Powder Study of Seed

Powder analysis of crude drug revealed the presence of fragments of epicarp, mesocarp, vittae, endosperms, trichomes, vessels and seclereids (Anonymous, 2007).

Identification and Purity

The TLC behaviour of the petroleum ether reveals the two peak spots which possessed R_f values of 0.11 and 0.87, respectively (Anonymous, 2007).

The different parameters for the standard purity tests were done and the results are given in table 1.

Table 1: Identification and purity parameters of Anisoon

Name of Parameter	Value of the Test
Foreign Matter	Not more than 2%
Total Ash Value	Not more than 17%
Acid Insoluble Ash	Not more than 7%
Alcohol soluble extractives	Not less than 1.5%
Water soluble extractives	Not less than 16%

Parts Used

The medicinal parts are fruit of anise (Aniseeds) and the essential oil from the ripe fruit and dried fruit (Evans, 2002; Anonymous, 2000). In USM, seeds of Anisoon are used (*Tukhme Anisoon*) medicinally.

Mizaj (Temperament)

Unani physicians described the *Mizaj* (temperament) of Anisoon (*Pimpinella anisum*) as:

- Hot 2nd degree and Dry 3rd degree (Ghani, 2011; Kareem, YNM),
- Hot and Dry 2nd degree (Ghani, 2011; Kareem, YNM; Kabiruddin, YNM),
- Hot and Dry 3rd degree (Ibn Baitar, YNM; Ghani, 2011; Baghdadi, 2005; Anonymous, 2007).

Miqdare Khorak (Dose)

Seeds: 2 to 5 gm (Tariq, 2010; Kabiruddin, YNM; Anonymous, 2007), 7 to 10 gm (Hakim, 1999).

Oil: 2 to 3 drops (Tariq, 2010; Ali 1993).

Mazarrat (Side effects)

Anisoon has been described to produce adverse effects on intestines (Kareem, YNM), urinary bladder, stomach and lungs (Ghani, 2011; Kabiruddin, YNM; Tariq, 2010).

Musleh (Corrective)

Sikanjabeen and *Saunf* (*Illicium verum*) are used as *musleh* (Ghani, 2011; Kareem, YNM; Kabiruddin, YNM; Tariq, 2010).

Murakkabat (Compound Formulations of Anisoon)

Arq-e-Badiyan (Anonymous, 2005), Sharbat-e-Farasiun, Qurs-e-Rewand, Jawarish-e-Jalali, Jawarish-e-Kholikhan, Jawarish-e-Khozi, Jawarish-e-Qurtum,

Safoof Namak Shaikhur-Raees, Safoof Namak Sulemani, Dawa-e-Ajeeb (Ramlubhaya, 2004), Jawarish-e-Ood Shireen, Habb-e-shab-e-yar (Anonymous, 2007; Ali 1993). Jawarish-e-Narmushuk, Jawarish-e-Shaheryaran, Itrifal-e-Ghuddadi, Hab-e-Iyarij, Majoon-e-Antaki, Majoon-e-Jalinoos Lului, Sufoof-e-Moya (Anonymous, 2007)

Afa'al (Action)

Following different pharmacological actions of anisoon (*Pimpinella anisum*) have been described in the literature:

Kasir-e-Riyah (Carminativae) (Ibn Baitar, YNM; Anonymous, 2007), Mohallil-e-Riyah (Antiflatulant) (Ghani, 2011; Hakim, 1999; Anonymous, 2007), Muqawwi-e-Meda wa Fam-e-Meda: (Stomach Tonic) (Kareem, YNM), Habis-e-Shikam (Astringent) (Ibn Baitar, YNM), Mushtahi (Appetizer) (Tariq, 2010) Mushil (Purgative) (Ibn Baitar, YNM; Ghani, 2011), Mufatteh (Deobsruent) (Kabiruddin, YNM; Ahmad, 2010), Mufatteh Sudad (Deobsruent) (Anonymous, 2007), Musakkin-e-Auja (Analgesic) (Hakim, 1999; Baghdadi, 2005; Kareem, YNM; Ibn Baitar, YNM; Ghani, 2011), Munaffis-e-Balgham (Expectorant) (Kabiruddin, YNM), Mukhrij-e-Balgham, Muddir-e-Bol (Diuretic) Ghani, 2011; Anonymous, 2007), Muddir-e-Haiz: (Emmenogauge) (Ghani, 2011; Baghdadi, 2005; Anonymous, 2007), Muddir-e-Sheer (Galactogauge) (Hakim, 1999; Baghdadi, 2005) Jali (Detergent) (Kareem, YNM) Musakkhin (Calorific) (Ramlubhaya, 2004) Mulattif (Demulcent) (Ghani, 2011; Hakim, 1999), Mohallil-e-Warm (Anti-inflammatory) (Ghani, 2011; Ibn Baitar, YNM;), Mohallil (Resolvent) (Baghdadi, 2005), Muarriq (Diaphoretic) (Ibn Baitar, YNM), Muhassin-e-Lone (skin fairer) (Ghani, 2011), Muqawwi-e-Bah (Aphrodisiac) (Ibn Baitar, YNM), Muqawwi-e-Gurda (Renal Tonic) (Ghani, 2011), Mufattit-e-Hisat (Lithotriptic) (Kareem, YNM), Musqite Janeen wa Mashima (Abortificient) (Ghani, 2011), Dafa-e-Tashannuj (Anticonvulsant) (Ghani, 2011; Anonymous, 2007), Qatile Qumal (Lice killer) (Kareem, YNM).

Istemalat (Uses)

Anisoon (*Pimpinella anisum*) has been described to be useful in various diseases such as *Sailanur Rahem* (discharges from the uterus) (Ghani, 2011; Baghdadi, 2005; Ibn Baitar, YNM) in both decoction and *Humool* (tampon) form (Jeelani, 2005; Razi, 2001). It acts as *mufatteh-sudad* (Deobsruent) (Anonymous, 2007). Its decoction is useful in *sudad-e-jigar wa tihal* (Ibn Baitar, YNM), *wa masana wa rahem* (Ramlubhaya, 2004). Its fumigation helps in expulsion of foetus (Hakim, 1999) and relieves *suda-e-barid* (Baghdadi, 2005). It is beneficial in *istasqa* (Ascites) (Ibn Baitar, YNM; Kareem, YNM). *Biryan* (roasted) anisoon is used in *bawasir* (Piles) (Hakim, 1999); its powder is especially effective in *bawasir-e-rehi* (Ghani, 2011).

Anisoon clears facial complexion (Hakim, 1999) and increases milk secretion (Ibn Baitar, YNM). Its oral form is used in *idrar-e-haiz* and *qillat-e-sheer* (Ramlubhaya, 2004). It resolves *riyah* (flatulance) and relieves intestinal colic (Hakim, 1999). Due to its *kasir-e-riyah* property, it is used in *dard-e-shikam* (Abdominal pain) and *dard-e-gurda rehi*. Being a *musakhkhin* it increases body temperature. Because of its *munaffis-e-balgham* property, it expels out *balgham* (Expectorant) in patients of *dama* (asthma) and *suaal* (cough). Being *jali* (detergent), anisoon cleanes *akhlat-e-lazija wa ghaliza* from *meda wa rahem* (Ramlubhaya, 2004).

Powdered anisoon 1.5 gm, mastagi (*Pistacia lentiscus*) 4 ratti (500 mg) mixed with *arq-e-qaranfal* (*Myrtus caryophyllus Spreng*) and *gulqand* (Rose petal jam) 3 tola (30 gm) is used in *qabz* (constipation) (Ramlubhaya, 2004). Its *bakhoor* and *saoot* is effective in *dare-d-sar barid* (cold headache), *shaqiqa* (migraine), *duwar* (vertigo), *barid nazla* (common cold), *falij* (Paralysis), *laqwa* (facial palsy) *wa istarkha* and otalgia (Hakim, 1999). Its fine powder mixed with *roghan-e-gul* (rose oil) is useful in otalgia (Ghani, 2011). *Zimad* of anisoon is beneficial in *istarkha* (Hakim, 1999). Its *surma* is efficacious in eye diseases (Ghani, 2011; Ibn Baitar, YNM).

Its *manjan* (tooth powder) is useful in foul smelling of mouth and cleaning of teeth (Ibn Baitar, YNM). Chewing of anisoon seeds is very effective in *suda-e-barid*, *shaqiqa, dard-e-seena* (chest pain), *khansi* (cough), *dama* (asthma), *khafqan* (palpitation). Its powder in *roghan-e-gul* (rose oil) is useful in *shagaf-e-androoni uzn* (tear in internal ear) due to trauma (Ibn Baitar, YNM). Its decoction with *aslus-soos* (*Glycyrrhiza glabra* Linn) is beneficial in *dama* (asthma) and chest diseases (Ibn Baitar, YNM), *shaqiqa, khafqan, sardi, khansi, darde sar barid* and beneficial for lungs (Ghani, 2011). It is effective in *laisar-e-ghus* and *sabat-e-balghami* because it changes temperament of brain and acts as a *muqawi-e-maida* (Ghani, 2011). *Joshanda* of 7 gm anisoon in water mixed with *gulqand-e-asli* 3 *tola* (30 gm) is effective in *sabaat* (coma), which is caused by *kharij sardi* or consumption of *advia-e-mukhaddira* (sedatives) (Ghani, 2011).

Powder of anisoon mixed with *gulqand* (ose petal jam) cures *malenkholia* (schizophrenia), especially in *malenkholia miraqi. Joshanda* of anisoon with *shahed* (honey) is beneficial in *qaboos* (nightmare) and *falij*. Joshanda of anisoon with sugar used to dissolve yellowness of cheeks of mother after delivery. Chewing of anisoon is carminative; it acts as *muqawwi-e-fam-e-maida,* and expel out its *ratoobat*. It has diuretic action and is effective in renal calculi. It is effective in *tape balghami kohna* (chronic phlegmatic fever) (Ghani, 2011) and useful in chronic fevers (Ibn Baitar, YNM). It is used as a *muqawwi-e-bah wa muqawwi-e-gurda* (Ghani, 2011).

It acts as an antidote in insect bite poisoning (Ibn Baitar, YNM) and acts as an antidote of some poisons (Ghani, 2011). *Roghan-e-anisoon* is *daf-e-tashannuj*

(anticonvulsant) (Ghani, 2011; Tariq, 2010). Anisoon is used to lessen the intestinal colic one of the common side effects of *advia-e-mushila* (laxative) (Ghani, 2011; Kareem, YNM).

Therapeutic uses as described in Ethno-medicine

The local application of oil of anisoon is useful in headache, flatulence and intestinal colic (Khare, 2004; Nadkarni, 2007). Its root is used in fever (Khare, 2004; Anonymous, 2005). It is used in liver diseases on account of having hepatotonic effect (Khare, 2004; Anonymous, 2000). It is also used in gall bladder complaints (Khare, 2004), common cold, cough, bronchitis (Anonymous, 2000), bronchial catarrh (Nadkarni, 2007) and whooping cough (Anonymous, 2000). Anise oil is used externally to treat lice and scabies (Prajapati *et al*, 2003; Khare, 2004).

It is used as aroma in toilet soaps and dentifrices (Khare, 2004). Anise leaves are used for garnishing and flavouring purposes (Nadkarni, 2007). Seed pods are used as a remedy for dyspepsia, relieve flatulence, indigestion, colic in children and to diminish the griping of purgatives (Nadkarni, 2007; Anonymous, 2000). Anisoon used as an insect repellent (Anonymous, 2000). It is used in inflammation of mouth and pharynx (Anonymous, 2000), menstrual disturbances and tuberculosis (Anonymous, 2000) and also as an antiseptic (Anonymous, 2005).

In homeopathic medicine it is used for shoulder pain and lumbago (Anonymous, 2000). Its oil used externally as an insecticide against small insects such as head lice, mites and vermin (Anonymous, 2005). Oil of anise is used in perfumery, soaps and other toilet articles and for flavouring culinary preparations, confectionery, beverages and liqueur anisette. It is used in perfuming sachets, dental preparations and mouth washes, it is also used in the manufacture of lacquers. It is used as an ingredient of cough lozenges in combination with liquorice, also in the treatment of cholera to prepare gripe water. It has also fungicidal properties (Anonymous, 2005).

Phytochemistry

Anise contains 1.5 to 3.5% volatile oil, 10% fixed oil, proteins, mucilage, and starch. The volatile oil of Anisoon on steam distillation, has a characteristic odour and taste; colourless or pale yellow in colour (Kokate *et al*., 2007; Anonymous, 2005). The major compounds of the essential oil of anise seeds are trans-anethole, methylchavicol, anisaldehyde, estragole, (Nadkarni, 2007; Anonymous, 2000) cumarins, scopoletin, umbelliferone, estrols, terpenehydrocarbons, polyenes, and polyacetylenes (Gulcin *et al*., 2003). The essential oil of *Pimpinella anisum* L. fruits showed the presence of trans-anethole (93.9%) and estragole (2.4%). Other compounds that were found with concentration higher than 0.06% were

(E)-methyleugenol, α-cuparene, α-himachalene, β-bisabolene, p-anisaldehyde, and cis-anethole (Ozcan *et al*., 2006).

The composition of essential oil of *Pimpinella anisum* L. fruits obtained from different geographical areas of Europe, showed the presence of trans-anethole (76.9–93.7%) and γ-himachalene (0.4–8.2%), trans-pseudoisoeugenyl 2-methylbutyrate, p-anisaldehyde, and methylchavicol (Orav *et al*., 2008). The other phytochemical studies revealed that the plant and the seeds of *Pimpinella anisum* from Alberta showed trans-anethole 57.4% of whole plant and 75.2% of seed oil, respectively (Embong *et al*., 1997).

The major compounds obtained by supercritical extraction using CO_2, were anethole (90%), γ-himachalene (2−4%), p-anisaldehyde (<1%), methylchavicol (0.9−1.5%), cis-pseudoisoeugenyl 2-methylbutyrate (3%), and trans-pseudoisoeugenyl 2-methylbutyrate (1.3%) (Rodrigues *et al*., 2003). Volatile oil of anise contains specific gravity 0.978-0.988, optical rotation +1 to -2, refractive index 1.553-1.560 (Kokate *et al*., 2007).

A new terpene hydrocarbon called neophytadiene was isolated from aniseed in 1978 (Burkhardt *et al*., 1986); phenolic glycoside, 4-(β-d-glucopyranosyloxy) benzoic acid, was also isolated from aniseeds (Driks *et al*., 1984). Four new aromatic compounds were isolated from the polar portion of methanolic extract of anise fruits (Fujimatu *et al*., 2003). Quercetin 3-glucuronide, rutin, luteolin 7-glucoside, isoorientin, and isovitexin as crystalline compounds, apigenin 7-glucoside, and a luteolin glycoside as noncrystalline compounds from anise have also been isolated (Kunzemann *et al*., 1977).

The fatty acids composition of aniseed oil on silver ion HPLC showed isomeric 18:1 fatty acids oleic acid (cis 9–18:1), petroselinic acid (cis 6–18:1), and cis-vaccenic acid (cis11–18:1), respectively (Denev *et al*., 2011). Also three lignin-carbohydrate protein complexes were isolated from a hot water extract of its seeds by column chromatography (Lee *et al*., 2011).

Pharmacological studies

A number of studies have been carried out on *Pimpinella anisum* Linn in recent years showing that it possesses diverse pharmacological effects. Some of the important pharmacological studies conducted so far are briefly described below:

Antimicrobial activity

The antibacterial activities of different extracts of *Pimpinella anisum* L were studied by a number of research scholars (Akhtar *et al*., 2008; Gulcin *et al*. 2003; Ates *et al*., 2003; Chaudhry *et al*., 2006). Synergic antibacterial activity between *Thymus vulgaris* and *Pimpinella anisum* has also been reported (Al-Bayati, 2008).

Antifungal activity

The essential oil of aniseed showed significant inhibitory activity against fungi (Kosalek *et al*., 2005; Ozcan *et al*., 2006; Yazdani *et al*., 2009), and anethol was found to be the most active component (Shukla *et al*., 1987).

Analgesic and Anti-Inflammatory activity

Twaij *et al*, (1998) reported significant analgesic activity of *Pimpinella anisum* agianst benzoquinone induced writhing and in thermal tests. In another study it has been reported that the essential oil as well as fixed oil of *Pimpinella anisum* has a significant analgesic and anti-inflammatory effects (Tas *et al*., 2006).

Antioxidant Activity

In a study conducted by Gulcin *et al*., (2003) the antioxidant property of water and ethanolic extracts of aniseeds was evaluated and compared with synthetic antioxidants such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT) and α-tocopherol. Both extracts of aniseeds showed strong antioxidant activity. Rajeshwari *et al*., (2011) has reported *in vitro* and *in vivo* antioxidant potential of ethanolic extract of aniseeds, and proved scavenging activity. Similarly, the antioxidant potential of essential oil and oleoresins from anise seeds was studied, and showed highest antioxidant activity (Singh *et al*., 2008). Screening of antioxidant properties of some Umbelliferae fruits were done in Iran (including *Pimpinella anisum*), among them P. anisum extract showed the strongest activity. Further, a positive correlation was found between the antioxidant potency and flavonoid content of the fractions (Nickavar *et al*., 2009). In another study, water and alcohol extracts of anise seeds showed marked antioxidant activity (Ismail *et al*., 2004). An in vitro study of herbal tea of anise seeds showed antioxidant activity (Speisky *et al*., 2006).

Anticonvulsant activity

Anticonvulsant effects of essential oil of the fruits of *Pimpinella anisum* were reported against seizures induced by pentylenetetrazole (PTZ), maximal electroshock (MES) in male mice (Pourgholami *et al*., 1999); and picrotoxin-induced seizure in mice (Ghani *et al*., 1987; Heidari *et al*., 2005).

The cellular mechanisms probably produce hyper excitability, and causes enhancement of Ca_2+ channels activity or inhibition of voltage and/or Ca_2+ dependent K+ channels activity underlying post-hyperpolarization potential (Janahmadi *et al*., 2008).

Antiviral activity

The antiviral activity of its essential oil has been shown against PVX (potato virus), TMV (tobaccomosaic virus) and TRSV (tobacco ring spot virus by Shukla (1989).

Similarly, three lignin-carbohydrate-protein complexes (LC_1, LC_2, and LC_3) were isolated from a hot water extract of seeds of *Pimpinella anisum* showed antiviral activities against herpes simplex virus types 1 and 2, human cytomegalo virus, and measles virus (Lee *et al*., 2011).

Antidiabetic activity

The antidiabetic, hypolipidemic, and antioxidant activities of aniseeds showed a significant decrease in fasting blood, serum cholesterol, triglycerides and lipid peroxidation in RBC and plasma, and also rise in vitamin C was detected (Rejeshwari *et al*., 2011). Kreydiyyeh *et al*., (2003) reported that aniseed oil increased glucose absorption in the rat jejunum significantly, because the oil enhanced the activity of the Na^+-K^+ ATPase which increases the sodium gradient that gears the mucosal glucose transport.

Effect on gastrointestinal system

Acute gastric ulcer in rat was produced by various noxious chemicals and indomethacin showed a protective effect (Mofleh *et al*., 2007). The laxative efficacy of a phytotherapic compound containing *Pimpinella anisum* L., *Foeniculum vulgare* Miller, *Sambucus nigra* L., and *Cassia angustifolia* was reported in a randomized clinical trial, which included 20 patients with chronic constipation according to the criteria of the American Association of Gastroenterology (Picon *et al*., 2010). In a double blind clinical trial, the effect of anise extract on menopausal hot flashes for 4 weeks showed a significant reduction (Nahidi *et al*., 2008).

Muscle relaxant activity

The relaxant effect of *Pimpinella anisum* on isolated guinea pig tracheal chains and its possible mechanism were studied. The results showed that the relaxant effect of this plant is due to inhibitory effects on muscarinic receptors (Boskabady *et al*., 2001). In another study, antispasmodic and relaxant effects of three hydroalcoholic extracts of the aerial parts of *Pimpinella anisum* on rat anococcygeus smooth muscle showed good results (Tirapelli *et al*., 2007).

Dysmenorrhea

The effectiveness of a herbal capsule containing dried extracts of celery, saffron, and anise was compared with mefenamic acid in 180 females with primary dysmenorrhea. The results revealed that the efficacy of capsule was better than mefenamic acid in pain relief (Khoda *et al*, 2008).

Morphine dependence

The effects of anise oil were studied in mice on the expression and acquisition of conditioned place preference (CPP) induced by morphine. The findings showed that injection of essential oil of *P. anisum* has some aversive effects against

morphine induced conditioned aversion. In addition, this oil has also a GABA ergic effect (Sahraei *et al*., 2002).

Insecticidal activity

Essential oil of *Pimpinella anisum* by fumigation assay exhibited insecticidal activities against larvae of Lycoriella (Park *et al*., 2006). Prajapati *et al*., (2005) showed that the essential oils of *Juniperus macropoda* and *Pimpinella anisum* were highly effective as larvicidal and ovicidal against three mosquito species. In addition, the anise essential oil showed repellency against mosquito *Culex pipiens* (Erler *et al*., 2006). The exposure to vapours of essential oils from anise and cumin resulted in 100% mortality of the eggs (Tunc *et al*., 2000). The ascaricidal activity of p-anisaldehyde derived from anise seed oil against the house dust mites, Dermatophagoides farina has also been shown (Lee, 2004).

Conclusion

Anisoon is one of the important medicinal plants used in Unani system of medicine. In the classical literature, it has been described to be widely used as Kasir-e-riyah, Mohallil-e-Riyah, Muqawwi-e-Meda, Mushtahi, Mufatteh, Mufatteh Sudad, Munaffis-e- Balgham, Mukhrij-e-Balgham, Muddir-e-Bol. The recent studies especially on seeds and essential oil have demonstrated that it has antioxidant, antibacterial, antifungal, anticonvulsant, anti-inflammatory, analgesic, gastro-protective, antidiabetic and antiviral etc activities and various therapeutic uses supporting its therapeutic value of centuries and exposing it for further researches.

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The *Mizaj* (Temperament) Patterns versus Somatotypes: Concordance or Coincidence

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Abstract

One of the well accepted classifications of human population is based on race. Race refers to a group of people who share similar and distinct physical characteristics. It is a social concept, by which human beings identify and distinguish themselves from other groups. The term race was initially confined to groups of people speaking common language. By 17th Century race referred to physical (Phonotypical) traits. In Unani System of Medicine, ancient physicians had identified ten comprehensive features of the human body and termed them as *Ajnas-e-Ashrah*. Based on these features they classified human being into four categories who have different *Mizaj* (temperament) viz, *Damwi, Balghami, Safrawi, and Saudawi*. American psychologist William Sheldon (1898-1977) has also classified human beings into three types of personalities and termed them somatotypes. Sheldon's somatotypes are based only on physical characteristics or physique. He has expressed them numerically and named them as ectomorphs, mesomorphs and endomorphs. Sheldon's body types can be assessed by ten anthropometric measurements.

Present study has been conducted to explore the *Mizaj types* and somatotypes of the same subjects and to find out any relationship between these two methodologies and further to point out whether this relationship is merely a coincidence or has any statistical correlation?

Key words: *Mizaj, Ajnas-e-Ashrah*, Somatotypes, Anthropometry, Race, Phenotype

Introduction

The present study is a statistical scrutiny of the relationship between the personality types-*Mizaj* (Temperament) of Unani System of Medicine (USM) and Sheldon's personality type (Somatotypes). The human body is a wonderful creation of God, which has always been a source of curiosity for medical science. Although the basic frame work of human body is same, the phenotypic features are different (Dutta, 2004). Different systems of medicine classify the human beings into different groups depending on these features. Ancient Unani physicians had also classified human beings into four types of personalities viz, *Damwi* (Sanguine), *Balghami* (Phlegmatic), *Safrawi* (Choleric) and *Saudawi* (Melancholic) (Ibn Sina, 1966). In USM personality it is assessed by ten comprehensive features called *Ajnas-e-Ashra* (ten determinants) (Ahmad, 1980). To assess the *Mizaj* which is based on *Ajnas-e-Ashrah*, a questionnaire has been formulated by the physicians and scolars. This questionnaire has been quantified as it is based on qualitative entities. American psychologist William Sheldon (1898-1977) (Sheldon, 1942) had

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also classified human beings into three types of personality and termed them somatotypes. Sheldon's somatotypes are based on only physical characteristics or physique. He expressed them numerically and named them endomorphy, mesomorphy and ectomorphy, which seemed to be derived from the three layers of the human embryo, the endoderm, the mesoderm and the ectoderm. Sheldon's body types can be assessed by ten anthropometric measurements (http://www.age-of-the-sage.org/psychology/sheldon.html). Since there appears a similarity between the two therefore an observer may arrive at very similar results in determining a person's body type or otherwise. Hence a pilot study to determine the *Mizaj* types and somatotypes of the same subjects was conducted. Relationship if any between these two methodologies was scrutinized to find whether it is merely a coincidence or there is a statistical correlation between the two. The *Mizaj* of the volunteers included in the study was assessed with the help of validated Unani questionnaire, while somatotype was assessed with the Heath Carter software. Statistical scrutiny for concordance between *Mizaj* assessed by Unani questionnaire and by Sheldon's somatotype was explored.

Materials and Methods

A cross sectional, analytical study after the approval of the Institutional Ethics Committee was carried out. Three hundred and fifty healthy students of either gender between 18 to 25 years of age from Azam Campus, Camp area of Pune city of Maharashtra, India, were included for the study by random sampling method. Under 18 years and above 25 years of age and diseased individuals were excluded. The study was carried out from 14th August 2015 to 13th April, 2016.

I: Assessment of Mizaj by Unani questionnaire

Assessment of Mizaj was done by assessing the following ten parameters known as

Ajnas-e Asharah:

1. *Malmas* (The touch)
2. *Lahm-wo-Shahm* (Muscles and Fats)
3. *Ash'ar* (Hair of the body)
4. *Laun* (Colour of the body)
5. *Hay'at al-a'za* (Stature of the body)
6. *Kayfiyat al-infi'al* (Quality of passiveness of the organs)
7. *Naum wo-yaqzah* (Sleep and wakefulness)
8. *Af'al al-a'za* (Bodily functions)
9. *Fudhlat al-badan* (Excreta of the body)
10. *Infi'alat nafsaniyah* (Psychic reaction)

Quantification and validation of Unani questionnaire

For the assessment of *Mizaj*, a questionnaire based on the *Ajnas-e-Ashrah* was constructed. As all the ten parameters mentioned in the *Ajnas-e-Ashrah* are qualitative therefore, they were quantified on a scale of 1 to 10. Quantification was done as per the method of quantification mentioned by Unani physician Balinas (Falsafi, 1972). The quantification was based on different qualities i.e. *Kaifiyat* that the subjects possessed. The assessment was done by a single observer, an experienced Unani physician which was further validated by another Unani consultant. The quantification method is as follows:

Quantification of Kaifiyat

Proportion of the *Lahm-wo-Shahm* (Muscles and Fats) was assessed by Omron's body composition analyser. Skeletal muscles, subcutaneous fat and visceral fats were expressed in percentage. Quantification of *Lahm-wo-sham* for the specific *Mizaj* types was done by NIH/WHO guideline for BMI (Gallagher, 2000) (Table 1-3)

Table 1: Quantification of Kaifiyat

Sr. No.	Kaifiyat	Assigned score
1	Har – Yabis	4
2	Har – Ratab	3
3	Barid – Ratab	2
4	Barid – Yabis	1

Table 2: Gender wise grading of skeletal muscle chart

Gender	Age	Low (-)	Normal (0)	High (+)	Very High (++)
Female	18-39	< 24.3	24.3-30.3	30.4-35.3	> 25.4
	40-59	< 24.1	24.1-30.1	30.2-35.1	> 35.2
	60-80	< 23.9	23.9-29.9	30.0-34.9	> 35.0
Male	18-39	< 33.3	33.3-39.3	39.4-44.0	> 44.1
	40-59	< 33.1	33.1-39.1	39.2-43.8	> 43.9
	60-80	< 32.9	32.9-38.9	39.0-43.6	> 43.7

Source : Omron Healthcare

Table 3: Gender wise grading of body fat chart

Gender	Age	Low (-)	Normal (0)	High (+)	Very High (++)
Female	20-39	< 21.0	21.0-32.9	33.0-38.9	> 39.0
	40-59	< 23.0	23.0-33.9	34.0-39.9	> 40.0
	60-79	< 24.0	24.0-35.9	36.0-41.9	> 42.0
Male	20-39	< 8.0	8.0-19.9	20.0-24.9	> 25.0
	40-59	< 11.0	11.0-21.9	22.0-27.9	> 28.0
	60-79	< 13.0	13.0-24.9	25.0-29.9	> 30.0

Source : NIID/WHO guidelines for BMI

Source: Gallagher *et al*., American Journal of Clinical Nutrition, Vol. 72, Sept. 2000

II: Assessment of Sheldon's somatotypes

Somatotype was assessed by the Heath-Carter method. Barbara Honeyman Heath, a former associate of William Sheldon developed a method for assessment of somatotypes, which is known as 'The Heath-Carter Anthropometric Somatotype' (Carter, 2002).

Equipment for anthropometry: Following equipments were used for anthropometric measurements.

I. Stadiometer or height scale and headboard.
II. Weighing scale.
III. Small sliding caliper
IV. A flexible steel or fiberglass tape measure.
V. Skin fold caliper.

Measurement techniques:

Following ten anthropometric measurements were recorded.

1. Stature (height): Height scale with head board was used to measure height. It was taken with the subject standing straight, against an upright wall, touching the wall with heels, buttocks and back keeping the head in the Frankfort plane (the upper border of the ear opening and the lower border of the eye socket on a horizontal line), and the heels together. Subject was ask to stretch upwards and take and hold a full breath. Headboard was lowered until it firmly touched the vertex.
2. Body mass (weight): Weight of the subject wearing minimal clothing was recorded. Subject was asked to stand on weighing scale. Weight was recorded to the nearest tenth of a kilogram.

   Skin folds: After raising the subject's skin, subcutaneous tissue was held firmly between thumb and forefinger of the left hand away from the underlying muscle at the marked site. Edge of the skin fold calliper were applied 1 cm below the fingers of the left hand and allow them to exert their full pressure before reading at 2 sec the thickness of the fold. Skin folds of the right side of the body were used. Subject was asked to stand relaxed. The calf muscle skin fold was taken in sitting position.
3. Triceps skin fold: It was measured at the back of the arm at a level halfway on a line connecting the acromion and the olecranon processes while the subject is standing relaxed with his arm hanging in anatomical position.
4. Sub scapular skin fold: Sub scapular skin fold was measured on a line from the inferior angle of the scapula in a direction that is obliquely downwards and laterally at 45 degrees.

5. Supra spinale skin fold: Supra spinale fold was recorded by raising it to 5-7 cm (depending on the size of the subject) above the anterior superior iliac spine.
6. Medial calf skin fold: Vertical skin fold was raised on the medial side of the leg, at the level of the maximum girth of the calf.
7. Bi-epicondylar breadth of the Humerus: The width between the medial and lateral epicondyles of the humerus was recorded with the shoulder and elbow flexed to 90 degrees.
8. Bi-epicondylar breadth of the femur: Subject was asked to sit with knee bent at a right angle. Greatest distance was measured between the lateral and medial epi-condyles of the femur.
9. Upper arm girth, elbow flexed and tensed: Measurement was taken at the greatest girth of the arm.
10. Calf girth: The subject was asked to stand with feet slightly apart. The tape was placed around the calf and the maximum circumference was measured.

Stature and girths were recorded at the nearest mm, bi-epicondylar diameters at the nearest 0.5 mm, and skin-folds at the nearest 0.1 mm (Harpenden calliper).

Plotting the somato chart: All the ten anthropometric measurements were uploaded in a software. This software calculates individual somatotypes and shows the individuals somatoplot. Every individual somatoplot was then compared with Sheldon's curvilinear somatoplot having Hippocrates' four basic humors and their combinations. Thus *Mizaj* of each subject was assessed by Sheldon's somatotypes.

Statistical analysis

Data were entered in excel sheet and presented in the form of tables and graphs. It was further analyzed using IBM SPSS software system (version 20). The 'chi square test' was used to assess the significance. Probability (P) < 0.05 was considered as significant.

Results and Observations

The results calculated using Unani questionnaire method and the Sheldon's somatoplot have been presented in the following tables (4-5) and figures (1):

Table 4: Distribution of *Mizaj* of Studied Population by Unani questionnaire

Mizaj of Studied Population	**Total**	
	No.	**%**
Sanguine Phlegmatic	67	19.1
Sanguine Choleric	83	23.7

Mizaj of Studied Population	Total	
	No.	%
Sanguine Melancholic	7	2.0
Phlegmatic Sanguine	42	12.0
Phlegmatic Choleric	31	8.9
Phlegmatic Melancholic	10	2.9
Choleric Sanguine	69	19.7
Choleric Phlegmatic	8	2.3
Choleric Melancholic	4	1.1
Melancholic Sanguine	18	5.1
Melancholic Choleric	9	2.6
Melancholic Phlegmatic	2	0.6
TOTAL	**350**	**100.0**

Table 5: Distribution of Mizaj of Studied Population by Sheldon's somatoplot

Mizaj of Studied Population	Total	
	No.	%
Sanguine Phlegmatic	54	15.4
Sanguine Choleric	53	15.1
Sanguine Melancholic	7	2.0
Phlegmatic Sanguine	55	15.7
Phlegmatic Choleric	37	10.6
Phlegmatic Melancholic	14	4.0
Choleric Sanguine	73	20.9
Choleric Phlegmatic	4	1.1
Choleric Melancholic	5	1.4
Melancholic Sanguine	25	7.1
Melancholic Choleric	18	5.1
Melancholic Phlegmatic	5	1.4
Total	**350**	**100.0**

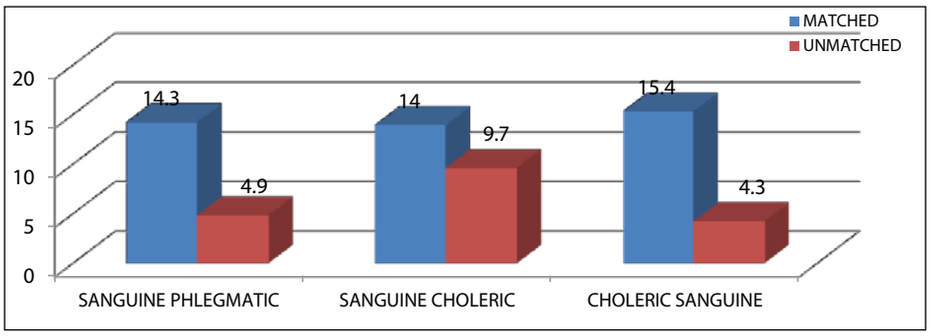

Figure 1: Mizaj wise matching proportions by Unani and Sheldon's method

Distribution of *Mizaj* viz, Sanguine Phlegmatic, Sanguine Choleric and Choleric Sanguine shows significantly higher concordance (80%) when matched by Unani questionnaire and Sheldon's somatoplot (p = 0.001 chi square test).

Discussion

As per the Unani system of medicine the human body depends on seven units known as *Al-Umur al-Tabi'yah* (Kabeeruddin, 1970). These are as follows:

1. *Al-Arkan or Al-Anasir* (Elements)
2. *Al-Mizaj* (Temperament)
3. *Al-Akhlat* (Humours- Body fluids)
4. *Al-A'za* (Organs)
5. *Al-Arwah* (Pneuma or vital spirit)
6. *Al-Quwa* (Faculties or power)
7. *Al-Af'al* (Body functions)

1. Al-Arkan: According to Hippocrates (460-377 B.C.), Aristotle (384-322 B.C.) and Galen(130-200) the human body is made up of four *Arkan* viz. *Al-nar* (Fire), *Al-hawa* (Air), *Al-ma'* (Water) and *Al-ardh* (Earth) (Gallagher *et al*., 2000).They attributed dual *Kafiyat* (qualities) to each *Unsur*. One quality is dominant where as one is recessive, these qualities express the properties of the *Arkan* (Hamdani, 1980).

   The above four elements are the basic components of the human body. *Hawa* stands for gaseous, *Ma'* stands for liquid, *Ardh* for solid components of the body and *Nar* for the ATPs generation as a result of food metabolism.

2. Al-Mizaj (Temperament): *Ibn Sina* defines Mizaj as "the new state of a matter which emerge after admixture of two or more than two elements of a compound. This compound has new qualities (*Kafiyat*) different from that of the elements or from which it has emerged. This uniform state of equilibrium is called as *Mizaj* (Temperament). *Mizaj* indicates the principles of chemical combination of different elements or compounds to form a new compound. Thus, each cell, tissue, organs or the entire body is bestowed upon with a *Mizaj*, which is known as *Mizaj mu'tadil* (normal temperament).

   When different *Ansir-al-Insaniyah* (Human elements) undergo various types of *imtizaj* (Chemical reaction/combinations) various compounds of specific *surat-nau'iyah* (molecular structure), having specific *Mizaj* are produced. These compounds constitute the *Akhlat-al-Badan* (Humors). The humors make the internal environment of the cells as well as of the whole body (milieu interior).

3. Al-Akhlat (Humors-Body fluids): The concept of *Akhalt* plays central role in Unani System of medicine. The word *Akhlat* (singular-*Khilt*) literally means admixture. All body fluids are termed as *Akhlat*, because the body fluids are not a single entity rather they are formed after metabolism and serve various functions like nutrition, growth, repair and preservation of health etc. in the body.

In 5th Century B.C. Hippocrates or *Buqarat* (460-337 BC) mentioned the theory of Humors or *Akhlat* in his book *"Tabiat al-Insan"*. According to his theory the human body contains four *Akhlat* (Humors) i.e. Blood or *Dum*, Phlegm or *Balgham*, Yellow bile or *Safra* and Black bile or *Sauda*.

Dominance of one of the above *Khilt* necessarily exerts its influence on the *Mizaj* (Temperament) of a person. Thus, according to dominance of the type of *Khilt* (Humors) human beings have been broadly classified into 4 types of *Mizaj* or personality *Damwi-ul-Mizaj, Balghami-ul-Mizaj, Safrawi-ul-Mizaj, Saudawi-ul-Mizaj.*

4. Al-A'za (Organs): Al-A'za are on the fourth positionin of *Al-Umur Al-Tabi'yah*. They are the solid structure of the body. They have formed from normal *Akhlat* having good composition and are the result of primary or basic transformation of normal *Akhlat. A'za* are of two types, *A'za-e-Mufrad* (simple) and *A'za-e-Murrakab* (compound).

5. Al-Arwah (Pneuma): The word Arwah is the plural of *Ruh* which means pneuma. Without *Ruh* the existence of life is impossible. All the gases in the body are called as *Arwah*, especially two gases, *Ruh* (oxygen) and *Bukharat-e-dukhaniya* (carbon dioxide).

6. Al-Quwa (Faculties or Power): *Al-Quwa* is the plural of *Quwat*. It is the also one of the unique concepts of Unani System of Medicine. It is the property of the body with which the human body carried out all its functions (*Af'aal*). It provides the basis for different bodily functions. Hence *Quwa* and *Af'aal* are inseparable. Each function requires its own special quwat. There are three major types of *quwa* in the body i.e. *Al-quwa al-Tabiyah* (natural faculties), *Al-quwa al-Nafsaniyah* (Psychic or mental faculties) and *Al-quwa al-Haywaniyah* (vital faculties).

7. Al-Af'al (Functions): *Al-Af'al* means functions. Body performs several functions with the help of Quwa. As mentioned they are inseparable, hence the classification of *Af'al* is same as that of *Quwa. Arkan* transforms into *A'za. A'za* in turn performs various *Af'al* with the help of *Quwa* and *Arwah*. Metabolism is one of the significant functions of *A'za*. After metabolism *Akhlat* are produced. *Akhlat* determines *Mizaj* or personality of an individual. In this way all the seven principles work in a proportionate manner to maintain the milieu interior (*Moatadil halat-e-badan*) of the human body.

   Mizaj (Temperament) is one of the important entities in Unani System of Medicine. Assessment of *Mizaj* is done in healthy as well as of disease persons. The questionnaire based on *Ajnas-e-Ashara* is used for assessment of *Mizaj* or personality types. It plays a very important role in determining the physical, physiological and psychological status of human being. Diagnosis of disease and principles of treatment are also based on the *Mizaj* of a person.

Sheldon's theory of Somatotypes

The somatotype is defined as the quantification of the present shape and composition of the human body. American psychologist William Sheldon (1942) has classified human being into three types and called them somatotypes. Sheldon's somatotypes are based only on physical characteristics or physique, named them endomorphy, mesomorphy and ectomorphy. Ten anthropometric measurements viz. stretch stature, body mass, four skinfolds (triceps, subscapular, supraspinale, medial calf), two bone breadths (biepicondylar humerus and femur), and two limb girths (arm flexed and tensed, calf) were recorded and uploaded on new comprehensive user-friendly software, which gives the individual's somatotype as well as Hippocrates' Mizaj and their combinations.

Charting somatotypes: It is an attempt to aid in the visualization of the relationship between the various somatotypes on a curvilinear triangle. The left sided numbers on the curvilinear triangle represents the degree of endomorphy, the upper numbers indicates the degree of mesomorphy, and the final or right number represents the degree of ectomorphy. The figure below is how this is typically illustrated.

Sheldon's somato plot and Hippocrates' four humors: Hippocrates' four temperaments and their different combinations have been incorporated into Sheldon's somatoplot. Below is the image of the Sheldon's curvilinear somatoplot with Hippocrates' four basic humors and their combinations (Figure 2).

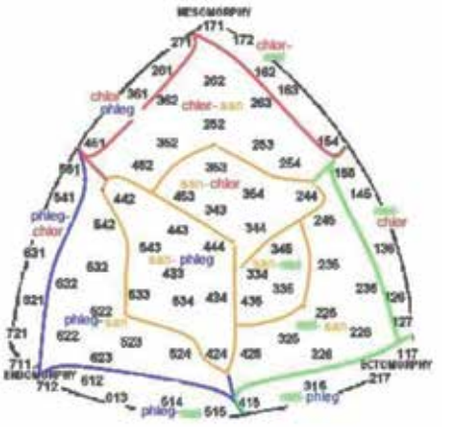

Figure 2: Sheldon's somatoplot with Hippocrates four humors

There is a great degree of similarity between *Mizaj* assessed by Unani questionnaire and that of Sheldon's somatotypes as 80% concordance was found between the two indicating least difference between two. Both appears to be complementary to each other The study indicated that somatotypes may also be used to assess the temperament along with the Unani tools however a larger and multicentric study is required to prove the exact concordance between the two.

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Safety Study of a Single Unani Drug Khare-e-khasak Khurd (*Tribulus terrestris* Linn.)

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Abstract

Present study was aimed to evaluate safety parameters in Khar-e-Khasak Khurd (*Tribulus terrestris* L.) - a very common drug used in Unani Medicine for its lithotriptic and aphrodisiac effect used in urinary disorders and impotence. Study reveals the presence of heavy metals lead, cadmium, mercury and arsenic within permissible limit as per WHO guidelines while aflatoxins, pesticides and microbial load was found to be absent in the crude drug sample. It can be said that the drug is free from toxicity.

Keywords: Khar-e-khasak khurd (*Tribulus terrestris* L.), Safety study, Herbal Medicine, WHO Guidelines

Introduction

Tribulus terrestris Linn (Family-Zygophyllaceae) known as Khar-e-khasak in Unani Medicine, Gokhru in Urdu, is a thorny fruit of *T. terrestris* mentioned in many classical Unani literature (Ghani, ynm). It has been used in India and China since time immemorial for health ailments as lithotripter, aphrodisiac and useful in strangury (Hashim *et al*., 2014). *T. terrestris* is an annual or perennial plant growing throughout India and other warm countries such as Ceylon (Chopra, 1958). According to Unani literature, Khar-e-khasak has been described morphologically of two varieties small (khurd) and Kalan (large/big) according to the size of fruit; among which mostly Khurd variety is medicinally used (Kabeer uddin, y.n.m). Renowned Unani scholars Rhazes (865-925 AD) mentioned Khar-e-khasak as lithotriptic, aphrodisiac, demulcent, and useful in strangury in his book *Kitabul Mansoori* (Razi, 2008), Usr-al-Baul (Dysuria), Sozak (Gonorrhoea), Urinary disorders, incontinence of urine and impotence (Khory, 1985), useful in strangury, vesicular calculi, pruritus ani, alleviate burning sensation (Kiritikar and Basu,1996). It possesses many actions like Mudir-i-Baul (Diuretic) (Chopra, 1958; Nadkarni, 1954), Musaffie dam (Blood purifier), have cooling effect and tonic to the body and used in calculus affection, kidney diseases and painful micturition (Dey1980).

Current practices of harvesting, production, transportation and storage of herbal drugs cause additional contamination and microbial growth proliferation of microorganism that may result from failure to control the moisture levels of herbal medicines during transportation and storage (Anonymous, 2007). Aflatoxin B_1, G_1, B_2, G_2, are fungal secondary toxic metabolites produced by *Aspergillus flavus, Aspergillus parasiticus and Aspergillus nomius*. Aflatoxins are the strongest natural carcinogens and their main target organ is the liver. The International Agency for Research on Cancer (IARC) has classified aflatoxin B_1 in the group 1 as a human

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carcinogens and aflatoxin G_1, B_2 and G_2 in the group B_2 as possible carcinogens to humans (Meritxell Ventura, 2004). Contamination of herbal materials with toxic substances such as arsenic can be attributed to many factors. These include environmental pollution (i.e. contaminated emissions from factories, leaded petrol, and contaminated water including runoff water which finds its way into rivers, lakes and sea, and some pesticides), Soil composition and fertilizers. The contamination of the herbal material leads to contamination of the products during various stages of the manufacturing process (Anonymous, 2007). The worldwide consumption of herbal medicines is enormous, so in terms of population exposure alone, it is essential to identify the risks associated with their use as safety of herbal medicines is an important public health issue (Anonymous, 2004). Present study is an attempt to assess these safety parameters in a well known herbal drug used in Unani Medicine Khar-e-khasak khurd (*T. terrestris* Linn.).

Material and Methods

Sample preparation:

The test drug Khare-e-khasak khurd (*T. terriestris* Linn) was procured from local market of Aligarh city in the month of May 2016 and was properly identified according to the morphological features mentioned in botanical and Unani literature & then further confirmed in Pharmacognosy section of department of Ilmul Advia, A.M.U., Aligarh. A herbarium sample of the test drug was prepared & submitted to Mawalid-e-salasa museum of the department after identification for further reference with Voucher no, SC-0188/15.

The drug was cleaned from the earthy material, washed with double distilled water and dried at 45º C in hot air oven to powder it in electrical grinder. There after the drug was passed through sieve no. 80 to confirm its fineness and uniformity of particle size. Finally the powdered drug was stored in an air tight container for experimental study.

The powder of test drug was studied to evaluate the presence of microbial load, pesticides residue, aflatoxins and heavy metals at Delhi Test House, Azadpur (New Delhi) as per WHO Guidelines.

1. Microbiological determination tests

Total viable aerobic count (TVC)

For detection of the anti-bacterial activity of the test drug, the total viable aerobic count (TVC) of the test drug was carried out, as specified in the test procedure, using plate count, results are shown in table-1.

Pre-treatment of the test drug

Depending on the nature of the herbal drug sample used, it was dissolved using a suitable method and any antimicrobial property present in the sample was eliminated by dilution or neutralization. Buffered Sodium Chloride-Peptone Solution, pH 7.0 (MM1275-500G, Himedia Labs, Mumbai, India) was used to dilute the test sample.

Test procedures

Plate count for bacteria and fungi

For bacteria: 1 ml of the pretreated test sample was added to about 15 ml of the liquefied casein-soybean digest agar in a petridish of 90 mm diameter at a temperature not exceeding 45 0C. Alternatively the test sample was spreadon the surface of the solidified medium. Two dishes were prepared with the same dilution, they were inverted and incubated at 30-350C for 48-72 hrs. unless a more reliable count was obtained in a short period of time. The number of colonies so formed was counted and the results were calculated using the plates with the largest number of colonies, up to a maximum of 300.

For fungi: 1 ml of the pretreated test sample was added to about 15 ml of the liquefied Sabouraud glucose agar with antibiotics in a petridish of 90 mm diameter at a temperature not exceeding 450C. Alternatively the test sample was spreadon the surface of the solidified medium. Two dishes were prepared with the same dilution; they were inverted and incubated at 20 - 250C for 5 days, unless a more reliable count was obtained in a short period of time. The number of colonies so formed was counted and the results were calculated using the plates with not more than 100 colonies. (Lohar, 2007).

2. Estimation of Aflatoxins sample preparation

The test for determination of the aflatoxins was carried out using LCMS-MS. 2gm of test drug was blended at high speed with 20 ml of 60% acetonitrile/water for two minutes. The blended sample was centrifuged for ten minutes using 1600 rpm (av.), supernatant was retained and diluted with 2 ml of filtrate with 48 ml of phosphate buffered saline (PBS, pH 7.4) to give a solvent concentration of 2.5% or less; methanol/water was prepared by taking 2 ml of sample and diluted with 14 ml of PBS (pH 7.4) to give a solvent concentration of 10% or less. The sample diluent was passed through the immunoaffinity column at a flow rate of 5 ml/ min. The column was then washed by passing 20 ml of distilled water through the column at the flow rate of approximately 5 ml/ min and dried by rapidly passing air through the column. 1.5 ml of distilled water was added to the sample elute.

500 µl of sample was injected onto the LCMS-MS (LC- Perkin, MS Applied Bio System, Model No.2000, Mobile Phase). A- Water 100%, B-ACN 100%, Column oven temperature = 30, Column ZORBAX Rx c18, narrow base 2.1×150 mm - 5 micron, Flow = 0.750 ml). The aflatoxin concentration was quantified by comparing sample peak heights or areas to the total aflatoxin standard (R-Biopharm) (Lohar, 2007). Results so found are shown in table-2.

3. Heavy metals

Heavy metals including Arsenic, Mercury, Cadmium and lead were determined in the test sample using Atomic Absorption Spectroscopy (table-3).

4. Estimation of pesticidal residue

The test for determination of the aflatoxins was carried out using GC/MS. The test was done for the assessment of specific pesticide residues like Organochloride compounds, Organophosphorous compounds, and Pyrethroids compound (Ramkrishanan, *et al*, 2015) as depicted in Table-4.

Figure 1: Khar-e-khasak Khurd (*Tribulus terrestris* Linn.)

Plant of *Tribulus terrestris* Linn.

Fruits of *Tribulus terrestris* Linn.

Table 1(a): Microbial load in Khar-e-khasak khurd

S. No.	Microbes	Result	Permissible limit
1.	Total Bacterial Count	680	Not more than $1x10^5$ cfu/gm
2.	Total Yeast & Mould	50	Not more than 1 $x10^3$ cfu/gm

Table 1(b): Test for specific pathogens in Khar-e-khasak khurd

S. No.	Pathogens	Result (gm)	Permissible limits as
1.	*E.coli*	Absent	Absent
2.	*Salmonella*	Absent	Absent
3.	*S. aureus*	Absent	Absent
4.	*P. aeruginosa*	Absent	Absent

Table 2: Aflatoxin in Khar-e-khasak khurd

S. No.	Aflatoxin	Result	LOQ (mg/kg)	Permissible Limit (mg/kg)
1	Aflatoxin B_1	BLQ	0.001	Not more than 0.5
2.	Aflatoxin G_1	BLQ	0.001	Not more than 0.5
3.	Aflatoxin G_2	BLQ	0.001	Not more than 0.1
4.	Aflatoxin B_2	BLQ	0.001	Not more than 0.1

LOQ = Limit of quantification

BLQ = Below the limit of quantification

Table 3: Heavy Metal in Khar-e-khasak khurd

S. No.	Test parameter	Result (mg/kg)	LOQ (mg/kg)	Permissible limit (mg/kg)
1.	Lead (Pb)	Not detected	2.50	Not more than 10
2.	Mercury (Hg)	Not detected	0.5	Not more than 1
3.	Arsenic (As)	Not detected	1.25	Not more than 3
4.	Cadmium (Cd)	Not detected	0.25	Not more than 0.3

LOQ = Limit of Quantification

BLQ = Below the limit of Quantification

Table 4: Pesticidal residue in Khar-e-khasak khurd

S. No.	Pesticide	Result	LOQ (mg/kg)	Permissible Limit (mg/kg)
1.	Alachlor	Not detected	0.02	0.02
2.	Aldrin & Dieldrin	Not detected	0.04	0.05
3.	Azinophos-methyl	Not detected	0.04	1.0
4.	Bromopropylate	Not detected	0.08	3.0
5.	Chlordane	Not detected	0.04	0.05
6.	Chlorfenvinphos	Not detected	0.04	0.5
7.	Chlorpyrifos	Not detected	0.04	0.2
8.	Chlorpyrifos-methyl	Not detected	0.04	0.1
9.	Cypermethrin	Not detected	0.10	1.0
10.	DDT (Sum of pp-DDT, pp-DDE and pp-TDE	Not detected	0.04	1.0
11.	Deltamethrin	Not detected	0.10	0.5
12.	Diazinon	Not detected	0.04	0.5
13.	Dichlorvos	Not detected	0.04	1.0
14.	Dithiocarbamates	Not detected	0.01	2.0
15.	Endosulfan (Sum of Isomer and Endosulfan sulphate)	Not detected	0.04	3.0

S. No.	Pesticide	Result	LOQ (mg/kg)	Permissible Limit (mg/kg)
16.	Endrin	Not detected	0.04	0.05
17.	Ethion	Not detected	0.04	2.0
18.	Fenitrothion	Not detected	0.04	0.05
19.	Fenvalerate	Not detected	0.10	1.5
20.	Fonofos	Not detected	0.04	0.05
21.	Heptachlor (Sum of Heptacholar & Heptachlor epoxide)	Not detected	0.04	0.05
22.	Hexachlorobenzene	Not detected	0.04	0.1
23.	Hexachlorocyclohexane isomer (other than ý)	Not detected	0.04	0.3
24.	Lindane (ý-Hexachlorocylohexane)	Not detected	0.04	0.6
25.	Malathion	Not detected	0.04	1.0
26.	Methidathion	Not detected	0.04	0.2
27.	Parathion	Not detected	0.04	0.5
28.	Parathion Methyl	Not detected	0.04	0.2
29.	Permethrin	Not detected	0.04	1.0
30.	Phosalone	Not detected	0.04	0.1
31.	Piperonyl butoxide	Not detected	0.04	3.0
32.	Primiphos Methyl	Not detected	0.04	4.0
33.	Pyrethrins	Not detected	0.10	3.0
34.	Quintozen (Sum of Quintozene, pentachloroaniline and methyl pentachlorophenyl sulphide)	Not detected	0.10	1.0

Results and Discussion

All four parameters undertaken in the study are considered instrumental to determine the safety/ toxicity of drugs. The result of the study demonstrated that heavy metals (Arsenic, Mercury, Cadmium and Lead) were not found to be present. Their presence cause serious effects on human body as Aflatoxin (B_1, B_2, G_1 and G_2) cause serious side effects such as hepatotoxity, carcinogenetic etc. Microbial count (Bacterial, yeast and Mould) were found below permissible limit, which is unable to produce any toxicity. This drug is also free from pesticide residue contamination.

The study revealed that the safety parameters carried out on Khar-e-khasak khurd (*Tribulus terrestris*) are within the permissible limits which indicate that drug is quite safe as per WHO requirement.

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Study of Market Samples of *Khulanjan* for Their Quality Standards

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Abstract

Adulteration and substitution are common in commercial samples of many drugs due to resemblance between two or more drugs which are easily mixed with one another giving confounding characters. Consequently, market samples of some of the drugs are available as either completely substituted or a mixed bag of genuine and substituted drugs. In view of regular use of *Khulanjan* in Unani Medicine and reports of its being admixed with spurious or low quality substitutes, present study was undertaken to study its three samples, two collected from market and one obtained from natural habitat. Pharmacognostical parameters were applied to all the samples to ascertain authenticity of commercially available samples by comparing them with the standard sample. The study consisted of macroscopic, physicochemical and phytochemical studies and spectrophotometery of all the samples. Findings of the study in most of the parameters were found almost similar indicating market samples of the drug to be genuine.

Key words: Unani Medicine, Crude drugs, Market samples, Adulteration, Standardization; *Khulanjan*

Introduction

Centuries old practice of Unani medicine is testimony to its therapeutic potential. It uses drugs of natural sources preferably that of plant origin. Traditional medical systems including Unani medicine that use natural drugs are facing serious problems pertaining to the availability of authentic drugs. Commercially available samples of some of plant drugs are frequently found adulterated or substituted. Growing awareness and increased use of herbal drugs have resulted in injudicious exploitation of wild sources of certain drugs which favored adulteration and substitution. Adulteration and substitution are not only creating problems to physicians and researchers but are also compromising the efficacy of a number of important drugs.

Crude herbal drug market has been in the domain of non medical men, who themselves and the workers they employed to collect the drugs have little idea of identity and quality of drugs and remain least bothered for such attributes. Such practices put a question mark on the authenticity of the crude drugs available in the market. It has been observed that many samples of plant drugs procured from different markets do not match with the description given in the literature. And it becomes a matter of great concern when entirely different samples are available in the market in place of a genuine drug (Bonakdar, 2002).

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Pharmacognosy is a reliable tool by which much information about crude drugs can be obtained (Soni, 2011). Detailed pharmacognostical evaluation gives valuable information about characteristics of crude drugs. If pharmacognostical techniques and classical approaches are applied together for authentication of a drug, better results can be obtained. Regulatory authorities are also in favour of such guidelines. Exclusive literature review and market and field surveys can provide additional benefit in this regard.

Kulanjan (*Alpinia galanga* Linn.) is an important drug of Unani medicine used in common practice and included in a number of pharmacopoeal and non-pharmacopoeal formulations on account of being attributed to possess different pharmacological effects (Shetty, 2005; Verma, 2011; Girija 2014; Kabeeruddin, 2007; Saeed, 2007; Khan 2012). However, it is frequently adulterated with other drugs that have simulating physical appearance. It affects the quality and thereby the efficacy of the preparations. In view of the above, three different samples of *Khulanjan* were taken up for the present study. One sample was collected from the habitat and was considered as standard. Two samples of the same drug were obtained from two different markets. All three samples were studied on certain Pharmacognostical parameters with an aim to compare the findings with one another to observe the differences, if any, between the samples.

Materials and Methods

Materials

Two market samples under the name of *Khulanjan* were procured from Bengaluru and Hyderabad's herbal drug markets and were designated as A and B, respectively. These samples were kept unidentified. The third samples named as C was collected from natural habitat (Herbal garden of National Institute of Unani Medicine (NIUM), Bengaluru (Figure 1) and was identified as *Alpinia galanga* Linn, by S. Noorunnisa Begum, Senior Asst. Professor, FRLHT, Bengaluru vide authentication certificate no. 3832. Sample C served as the standard sample. Voucher specimens of all the samples have been deposited in the drug museum of NIUM, Bengaluru. All the chemicals and reagents used in this study were of analytical grade.

Methods

Macroscopic/Organoleptic studies

The organoleptic characters like color, odor, taste, shape, size, and surface of all the samples were examined by naked eye as described by Wallis (2005).

Physicochemical studies

Total ash, acid insoluble ash and water soluble ash were determined by the method described in Physicochemical standards of Unani Formulations (Anonymous, 1987); extractive values in petroleum ether, benzene, chloroform, acetone, ethanol, and distilled water were determined by the method described in British pharmacopoeia (Anonymous, 1968). Moisture content was determined by the loss on drying method (Khandelwal, 2008). The pH value of 1% and 10% aqueous solution was checked by the method described in Physicochemical Standards of Unani Formulations (Anonymous, 1987).

Phytochemical studies

For preliminary phytochemical studies of extracts taken in different solvents *viz*. Petroleum ether, benzene, chloroform, acetone, ethanol, and distilled water were subjected to various qualitative phytochemical tests such as alkaloids, glycosides, carbohydrates, phenolic compounds, tannins, phytosterols, fixed oils, coumarins, diterpenes, flavonoides proteins and amino acids etc by different methods (Anonymous, 1987; Brewster, 1971; Bhattacharjee and Das, 1969; Khandelwal, 2008; Pandey, 2013).

Spectrophotometery (Spectrum scanning)

Spectrophotometery was performed with the help of UV-Vis Spectrophotometer (model Lab India 3000). Extracts of test drugs were analyzed against blank sample for visible wave length range (360-190 nm). The parameters were set and dark current correction was performed to ensure the accuracy of the measurement. Baseline correction was performed with the sample control cell, and then sample of drug was analyzed. Peak picking was done by threshold value. The observations were saved in graphical as well as tabular form to note maximum absorbance against particular wave length and the number of peaks. Other specifications included Spectral Bandwidth, 2.00 nm; Spectrum Performance: Scan Range, 190.00-900.00; Measure Mode, Abs; Interval, 5.00 nm. Speed: Fast.

A B C

Figure 1: Various samples of Khulanjan

Table 1: Organoleptic characters of various samples of *Khulanjan*

S. No.	Characteristics	Sample A	Sample B	Sample C
1.	Shape	Cylindrical, branched	Cylindrical, branched	Cylindrical, branched
2.	Size	2-4cm long, 0.1-0.2cm diameter	2-5cm long,0.1-0.2cm diameter	3-8cm long, 0.1cm diameter
3.	Colour	Dark brown	Reddish brown	Yellowish brown
4.	Odour	Pungent & Aromatic	Pungent & Aromatic	Pleasant & Aromatic
5.	Taste	Spicy	Spicy	Spicy & Sweet
6.	Surface	Rough	Rough	Rough

Table 2: Ash values of of various samples of *Khulanjan*

Samples	Ash Values		
	Total ash	Acid insoluble ash	Water soluble ash
A	4.25±0.03	0.89±0.07	2.75±0.16
B	4.91±0.04	3.76±0.27	1.59±0.33
C	5.64±0.15	2.80±0.19	1.45±0.09

Table 3: Extractive values of various samples of *Khulanjan* in different solvents

Samples	Solvents					
	Pet. Ether	Benzene	Chloroform	Acetone	Ethanol	Aqueous
A	2.56±0.30	1.82±0.38	1.744±1.744	3.53±0.392	2.10±0.20	11.05±0.38
B	1.14±0.26	1.45±0.30	0.307±0.307	1.51±0.34	2.10±0.20	23.94±1.07
C	2.26±0.25	0.55±0.09	0.342±0.342	1.84±0.29	10.83±0.46	16.05±0.52

Table 4: pH, Moisture Content and Solubility of various samples of *Khulanjan*

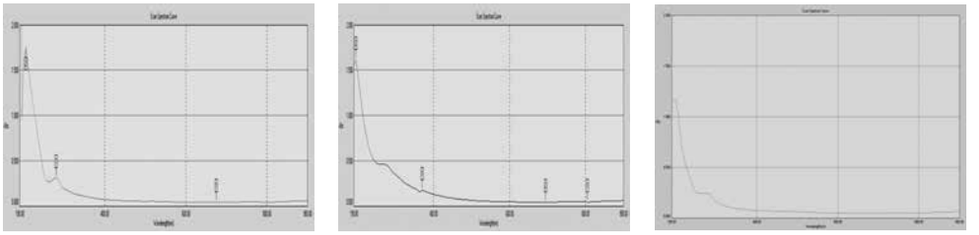
	Samples					
	1% solution			10% solution		
	A	B	C	A	B	C
pH	4.47±0.38	4.98±0.21	4.74±0.36	4.74±0.9	5.46±0.9	4.65±0.10
Moisture Content	10.57±0.04	9.79±0.08	9.13±0.01	-	-	-
Solubility	17.76±1.16	15.78±0.2	20.97±0.5	-	-	-

Table 5: Fluorescence analysis of powders of various samples of *Khulanjan*

S. No.	Treatment	Fluorescence					
		In daylight			In UV light		
		A	B	C	A	B	C
1.	Powder as such	Light brown	Light yellow	Yellowish brown	Gray	Gray	Gray
2.	Powder + 1N HCL	Red	Black	Reddish brown	Black	Greenish black	Dark brown
3.	Powder + 1N NaOH	Black	Reddish Yellow	Brown	Greenish Black	Greenish Black	Dark brown
4.	Powder + 50% HCL	Red	Red	Light Yellow	Greenish brown	Greenish	Dark Gray
5.	Powder + 50% H_2SO_4	Reddish brown	Gray	Reddish brown	Greenish black	Black	Dark green
6.	Powder + 50% HNO_3	Red	Red	Red	Black	Black	Brown
7.	Powder + Methanol	Red	Yellowish	Yellow	Gray	Gray	Gray
8.	Powder + Methanol + 1N NaOH	Reddish brown	Yellowish brown	Yellowish brown	Black	Yellowish brown	Dark brown

Table 6: Spectrophotometery: Aqueous extract

Aqueous extract								
Sample A			Sample B			Sample C		
Peak	Wave length (nm)	Absorbance	Peak	Wave length (nm)	Absorbance	Peak	Wave length (nm)	Absorbance
Peak-1	280.00	0.314	Peak-1	70.00	370.00	Peak-1	745.00	0.053
Peak-2	205.00	0.133	Peak-2	195.00	195.00	Peak-2	275.00	0.248

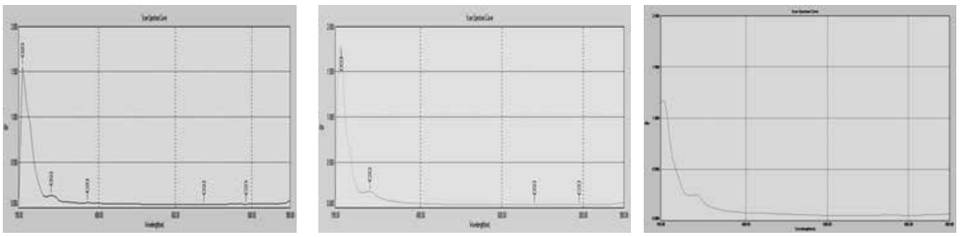


A B C

Figure 2: Spectrum scan curves: Aqueous extract

Table 7: Spectrophotometery: Ethanol extract

Ethanol extract								
Sample A			Sample B			Sample C		
Peak	Wave length (nm)	Absorbance	Peak	Wave length (nm)	Absorbance	Peak	Wave length (nm)	Absorbance
Peak-1	370.00	0.053	Peak-1	275.00	0.179	Peak-1	275.00	0.062
Peak-2	275.00	0.133	Peak-2	205.00	.779	Peak-2	195.00	1.535
Peak-3	200.00	1.558	-	-	-	-	-	-



A B C

Figure 3: Spectrum scan curves: Ethanol extract

Results and Discussion

A number of studies on commercial samples of plant origin drugs have revealed that many drugs were substituted and/or adulterated (Ansari, 1994; Afaq, 1994). Over the decades, on account of growing awareness about herbal drugs and the increasing demand for herbal products for various therapeutic application mindless exploitation of wild sources of these drugs has become rampant. Many traders of herbal drugs have indulged in malpractices taking advantage of this situation (Ansari, 1994; Afaq, 1994). Similar looking drugs are easily mixed and therefore the market samples of many crude drugs are either totally substituted or marketed as a mixture of genuine and substituted drugs. Therefore, it is necessary to standardize all the single drugs to rule out misidentification, adulteration and substitution of herbal drugs.

Standardization is the corner stone for ensuring the authenticity and genuineness of herbal drugs. Strategies have been made for standardization by most of the regulatory authorities which are based on macroscopy, microscopy, physicochemical and analytical studies.

Morphological characteristics are important in describing the deterioration of drugs due to faulty harvesting, shipment and storage. In our study we applied macroscopy to all the samples. The findings showed similarity with minor differences in all the samples with respect to shape, size and surface, however the colour was found a bit different (Figure1 a, b, c and Table 1). This may have arisen because of different storage conditions, age and source of the drugs.

Physical parameters for organized drugs usually includes ash values, extractive values, moisture content, solubility, and pH. We applied all these parameters. The findings of all three samples (A, B and C) were found to have similar character with minor or negligible differences, which were within the normal range. Acid insoluble ash of sample B was higher when compared with C; high acid insoluble ash indicates contamination with earthy material (Evans, 2008) (Table 2). Extractive values in a particular solvent are indicators of originality of the drugs. The petroleum ether extractive value of A and C was similar. Less value of sample B may be because of excessive drying or oldness of the drug. The benzene extract of A and B was found to be more than C. The chloroform extractive value of A was more than C. The acetone extractive values of sample A were more than C, whereas that of B was similar to C. The extractive value of C in ethanol was more than A and B. The aqueous extract of sample B was estimated to be more than C. but that of sample A was less than standard sample C (Table 3). The factors which influence the quality of an extract depends upon the extraction procedure, type of extraction, time of extraction, temperature, nature of solvent and polarity etc. (Tiwari *et al*., 2011). Slight differences in the extractive values may be taken as normal in view of the above factors. Aqueous solubility was found within the normal range. Moisture content of sample A and B was nearly equal (Table 4). The pH values of the three samples in 1% and 10% aqueous solution were also found within the normal range (Table 4). Preliminary phytochemical studies are not only good indicator of genuineness of drug but are considered more reliable than the physical parameters. *In certain cases, a particular test on a drug shows negative results but at the same time it shows positive result in other tests. In our study, it happened very often*. Preliminary phytochemical test carried out on the extract prepared in various solvents, revealed presence of alkaloids, carbohydrates, glycosides, terpenes/phytosterols, fixed oil, flavonoides, diterpenes, quinones, anthraquinones, saponins, proteins, amino acids and coumarins in all the samples. Terpenoids, which contains volatile oils, is insoluble in water and soluble in organic compounds (Doughari, 2012; Ahmad, 2007). Phenols and poly phenols can be extracted in water, ethanol, methanol, and acetone extracts (Tiwari *et al*., 2011). Fixed oils were positive in all the three samples of petroleum ether extract. Flavonoides can be extracted through, ethanol, methanol, chloroform, ether, and acetone (Tiwari *et al*., 2011). Tannins are soluble in water, dilute alkali, alcohol, and glycerol (Doughari, 2012;

Ahmad 2007). Saponin is soluble in water and alcohol. It is insoluble in non-polar organic solvents like benzene, hexane, chloroform etc. (Doughari , 2012; Ahmad, 2007). Proteins and amino acids are soluble, dilute in water, dilute acids, dilute alkali solutions, and dilute salt solutions, 70% alcohol. Xanthoproteinic test is used for the detection of presence of aromatic ring in amino acids (Doughari, 2012; Ahmad, 2007). Tests for inorganic constituents showed positive results for sulphates, iron and chloride in all the three samples.

Fluorescence analysis was also carried out during the study. Findings of our study revealed minor differences among the samples (Table 5) however the differences were not found to be significant.

Spectrophotometery is the measurement and interpretation of electromagnetic radiation absorbed or emitted (Sankar, 2010). This highly sensitive technique is frequently used for differentiation between similar looking drugs with the help of peaks observed in respect of different samples. If, it is allowed to run against a standard marker, phytoconstituents may also be characterized. But, in our study, spectrophotometery was appropriated to run against the blank sample, therefore the peaks could not be interpreted, however the nature and number of peaks can give a rough idea about the difference or similarity between two or more drugs. In our study, aqueous extract of all the samples gave two peaks but with minutely different wave lengths and absorbance. But, the ethanol extract gave three peaks in sample A and two peaks each in sample B and C again with minutely different wave lengths and absorbance (Table 6, 7 and Figure 2, 3). The findings suggested that there is inconsequential difference among the three samples. It indicates that samples available in the Hyderabad and Bangaluru are reliable and can be used for te preparation of herbal products. However the difference in the number of peaks in sample A must be investigated further to know whether it is an indicator of a phytoconstituent or something extraneous.

Conclusion

The study revealed similarity among the three samples collected from Bengaluru, Hyderabad and from the habitat of NIUM, Bengaluru. The findings of the study demonstrated that different physicochemical and analytical characters of market samples were same as that of the standard one, therefore, it was concluded that the market samples of *Khulanjan* collected from the markets were genuine.

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Safety Study of *'Qurs-e-Ziyabetus'*–A Unani Pharmacopoeial Compound Formulation

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Abstract

Plant drugs used in traditional medicines are liable to be contaminated with toxic substances. Plants are prone to be contaminated with them during the agricultural practices and thereafter and could lead to poisoning, besides side effects like depression, memory, loss of sensation and chronic renal failure etc. Contamination of herbal products is a public health issue of global significance and the use of these products may be a risk for toxicity of heavy metals and other toxicants. Therefore, safety studies of the herbal drugs are now mandatory as per WHO guidelines. It includes Aflatoxin determination, Heavy metal analysis, Pesticidal residue evaluation, and Microbial load determination. Although drugs under the Indian System of Medicine (ISM) are required to be manufactured in hygienic environment following the GMP norms after quality assurance of the raw materials still the products are tested for the toxicant mentioned above in order to ensure their safety and efficacy. Therefore, in present study, the powder of Qurs-e-Ziyabetus was studied on safety parameters.

The test drug (QZ) showed that all the safety parameters were found within the permissible limits as per WHO guidelines; hence we can say that our test drug Qurs-e-Ziyabetus (QZ) is quite safe and does not contain the toxic materials.

Key words: Safety study, *Qurs-e-Ziyabetus*, Unani drug

Introduction

In Unani system of medicine a number of single drugs and compound formulations are used in the management of Diabetes. *Qurs-e-Ziyabetus* (QZ) is an important compound preparation mentioned in various Qarabadeen (Pharmacopoeias and Formularies) with little variation of ingredients; though all the preparations are used for same therapeutic effect. The formulation under study however has been taken from Qarabadeen Aazam wa Akmal (Akmal, ynm) in view of its wide acceptability among the physicians who prescribe it in their routine practice to manage the diabetes and the conditions associated with it.

QZ includes a number of single herbal drugs (Table 1) as its ingredients that have been attributed to possess different pharmacological effect that may ameliorate the diabetic condition as such or induce such a response that may negotiate the complications arise out of diabetes. Since the management of diabetes requires inclusion of drugs in a combination that may address the need of lowering glucose level and other symptomatic and systemic relief therefore this combination appears to be comprehensive as it includes the drugs that have been described to reduce the glucose level and polyuria (Hafeez, 2005). As per Unani description the physiopathology arising mainly from kidney but also evolving spleen and

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liver etc along with certain metabolic disturbances, give rise to diabetes mellitus. Further, the disease over a period of time affects almost all organs and systems of the body vitiating the human health. Therefore a compound drug having different pharmacological effects to deal with diabetes and its complications appears to be more suitable as compared to single drug or a molecule. Some of the drugs described to strengthen the kidney and visceral organs improve the metabolism, reduce the thirst and have general tonic effect have been included in the test drug for wide therapeutic requirements. Ability of compound drugs to deal with complex problems notwithstanding being appreciable is sometimes undermined because of their poor quality standards, as any ingredient of inferior quality may spoil the measures of the entire product. The chances of contamination with different toxic substances are also high in compound preparations. Therefore, WHO has set a standard for herbal drugs and their products in respect of their quality and safety. Various constants of safety have been made mandatory to put within the permissible limits including aflatoxin, heavy metals, microbial loads and pesticide residues. Every product is therefore tested to determine the four constant of safety parameters.

Table 1: Ingredients of 'Qurs-e-Ziyabetus'

S. No	Ingredients	Botanical name	Quantity
1.	Tabasheer	*Bambusa arundinacea*	35 gm
2.	Rubbussus	*Extract of liqueorce*	35 gm
3.	Tukhm-e-kahu	*Lactuca sativa*	70 gm
4.	Tukhm-e-khurfa	*Portulaca oleracea*	52.5 gm
5.	Gil-e-armani	*Bole armeniae rubra*	17.5 gm
6.	Gul-e-surkh	*Rosa damascena*	17.5 gm
7.	Kishneez khushk	*Coriadrum sativum*	17.5 gm
8.	Samagh-e-arbi	*Acacia arabica*	7 gm
9.	Sandal safed	*Santalum album*	7 gm
10.	Sandal surkh	*Pterocarpus santalinum*	7 gm
11.	Gulnar	*Punica granatum*	2 gm
12.	Kaphur	*Cinnamomum camphora*	1.75 gm

The test drug despite being used commonly in clinical practice and being standardized on physicochemical parameters has not been studied on safety parameters that are necessary to ensure its quality as suggested by WHO.

Therefore present study was undertaken to determine the presence and concentration of aflatoxins, microbial load, pesticide residue and heavy metals.

Medicinal plants may get contaminated easily by absorbing heavy metals from soil, water and air. Usually soil is subjected to contamination through atmospheric deposition of heavy metals from point sources including different industrial activities. Additional sources of these elements for plants are rainfall, atmospheric dusts and plant protection agents (Nema, 2016). Herbal materials normally carry a large number of bacteria and moulds, often originating in soil or derived from manure. Current practices of harvesting, production, transportation and storage may cause additional contamination and microbial growth. Proliferation of microorganisms may result from failure to control the moisture level of herbal medicines during transportation and storage (Anonymous, 2007). Aflatoxins B_1, G_1, B_2 and G_2 are fungal secondary toxic metabolites produced by *Aspergillus flavus, Aspergillus parasiticus* and *Aspergillus nomius*. Aflatoxins are the strongest natural carcinogens mainly targeting the liver. The International Agency for Research on Cancer (IARC) has classified aflatoxin B_1 in the group 1 as a human carcinogen and aflatoxins G_1, B_2 and G_2 in the group 2B as possible carcinogens (Meritxellventura *et al*., 2004). Contamination of herbal materials with toxic substances such as arsenic can be attributed to many factors. Toxic elements from waste water may contaminate agricultural soil, water supply and environment. These toxic metals confined in plants finally enter the human body and may disturbs the normal functioning of central nervous system, liver, lungs, heart, kidney and brain leading to hypertension, abdominal pain, skin eruptions, intestinal ulcer and different types of malignancies (Nema, 2016; Anonymous, 2007).

The worldwide consumption of herbal medicines is enormous. So, it is essential to identify the risks associated with their use as safety of herbal medicines is an important public health issue (Anonymous, 2004). In view of the above, the present study was undertaken to prepare the safety profile of QZ.

Material and Method

Sample preparation

The crude drugs were procured from Dawakhana Tibbiya College, Aligarh Muslim University, Aligarh. After getting confirmation of purity and identity from Pharmacognosy section of Department of Ilmul Advia, all the ingredients were powdered in an electric grinder separately and mixed together in equal proportion as mentioned in the Pharmacopeia. The mixed drug was then passed through the sieve no. 80 to get equally fine powder. It was stored in an air tight container for further experiments.

Powdered test drug was studied to evaluate the presence of Microbial load, Pesticides residue, Aflatoxins and Heavy metals.

Microbiological determination Test

Total viable aerobic count (TVC)

The total viable aerobic count (TVC) of the test drug was determined using Plate Count Method.

Pretreatment of the test drug

Compound formulation was dissolved and antimicrobial property present in the sample, if any was eliminated by dilution or neutralization. Buffered Sodium Chloride-Peptone Solution, pH 7.0 (MM1275-500G), Himedia Labs, Mumbai, India, was used for diluting the test sample.

Plate count for bacteria

1 ml of the pretreated test sample was added to about 15 ml of the liquefied casein-soybean digest agar in a petri dish of 90 mm diameter at a temperature not exceeding 45 ºC. Alternatively the test sample was spread on the surface of the solidified medium. Two dishes were prepared with the same dilution; they were inverted and incubated at 30-35 ºC for 48-72 hours, unless a more reliable count was obtained in a short period of time. The number of colonies so formed was counted and the results were calculated using the plates with the largest number of colonies, up to a maximum of 300 (Lohar, 2007).

Test for pesticide residue

The test for the assessment of specific pesticide residues like organochlorine compounds, organ phosphorous compounds and pyrethroids compounds was done using GCMS-MS (Ramkrishanan *et al*., 2015).

Test for Aflatoxins

LCMS-MS was used to determine the different Aflatoxins including B_1, G_1, B_2 and G_2 (Maritxellventura *et al*., 2004).

Test for heavy metals

Heavy metals like Arsenic, Mercury, Cadmium and Lead, beyond the permissible limit affect the health and produce adverse effect on brain, kidney, developing foetus, normal growth, vascular and immune system (Moses and Moebe, 2012). This test was conducted using AAS technique.

Observations and Results

The results of the four tests have been presented in the following tables (1-4):

Table 1: Heavy Metals in Qurs-e-Ziyabetus

S. No	Test Parameter	Result (mg/ kg)	LOQ (mg/kg)	Permissible limit (mg/kg)
1	Lead (Pb)	9.4	2.50	NMT 10
2	Mercury (Hg)	Not detected	0.5	NMT 1
3	Arsenic (As)	Not detected	1.25	NMT 3
4	Cadmium (Cd)	Not detected	0.25	NMT 0.3

Table 2A: Microbial load in Qurs-e-Ziyabetus

S.No.	Test for Microbiology	Result (cfu/gm)	Permissible Limit (cfu/gm)
1	Total Bacterial Count	600	NMT 10^5
2	Total Yeast and Mould	<10	NMT 10^3

Table 2B: Microbial load in Qurs-e-Ziyabetus

S.No	Specific Pathogen	Result (/gm)	Permissible limits as per API
1.	*E. Coli*	Absent	Absent
2.	*Salmonella*	Absent	Absent
3.	*S. aureus*	Absent	Absent
4.	*P. aeruginosa*	Absent	Absent

Table 3: Aflatoxin in Qurs-e-Ziyabetus

S.No.	Aflatoxin	Result	LOQ (mg/kg)	Permissible Limit (mg/kg)
1	Aflatoxin B_1	Not detected	0.001	NMT 0.5
2	Aflatoxin G_1	Not detected	0.001	NMT 0.5
3	Aflatoxin B_2	Not detected	0.001	NMT 0.1
4	Aflatoxin G_2	Not detected	0.001	NMT 0.1

Table 4: Pesticidal residue in Qurs-e-Ziyabetus

S.No	Pesticide Residue	Result	LOQ (mg/kg)	Permissible limit (mg/kg)
1	Alachor	Not detected	0.02	0.02
2	Aldrin & Dieldrin	Not detected	0.04	0.05
3	Azinophos – methyl	Not detected	0.04	1.0
4	Bromopropylate	Not detected	0.08	3.0
5	Cholordane	Not detected	0.04	0.05
6	Chlorfenvinphos	Not detected	0.04	0.2
7	Cypermethrin (and isomers)	Not detected	0.10	1.0

8	Chlorpyrifos	Not detected	0.04	0.2
9	Chlorpyrifos-methyl	Not detected	0.04	0.1
10	DDT (Sum of p.p-DDT, p.p-DDE and p.p-TDE)	Not detected	0.04	1.0
11	Lindane	Not detected	0.04	0.6
12	Deltamethrin	Not detected	0.10	0.5
13	Diazinon	Not detected	0.04	0.5
14	Dichlorvos	Not detected	0.04	1.0
15	Dithiocarbamates(as CS2)	Not detected	0.01	2.0
16	Endosulfan (Sum of Isomer and EndosulfanSulphate)	Not detected	0.04	3.0
17	Endrin	Not detected	0.04	0.05
18	Ethion	Not detected	0.04	2.0
19	Fenitrothion	Not detected	0.04	0.5
20	Fenvalerate	Not detected	0.10	1.5
21	Fonofos	Not detected	0.04	0.05
22	Heptachlor (Sum of Heptachlor & Heptachlor epoxide)	Not detected	0.04	0.05
23	Hexachlorobenzene	Not detected	0.04	0.1
24	Hexachlorocyclohexane isomers	Not detected	0.04	0.3
25	Malathion	Not detected	0.04	1.0
26	Parathion	Not detected	0.04	0.5
27	Methidathion	Not detected	0.04	0.2
28	Parathion Methyl	Not detected	0.04	0.2
29	Piperonyl butoxide	Not detected	0.04	3.0
30	Primiphos Methyl	Not detected	0.04	4.0
31	Permethrin	Not detected	0.04	1.0
32	Pyrithrins (Sum of isomers)	Not detected	0.10	3.0
33	Phosalone	Not detected	0.04	0.1
34	Quintozen (Sum of Quintozene, pentachloroaniline and methyl pentachlorophenyl sulphate)	Not detected	0.10	1.0

Discussion

All the four parameters undertaken in the study to determine the safety of the test drug serve as important tools of quality control and standardization. Safety studies of herbal drugs and other products used in traditional medicines have become mandatory in order to ensure their quality and risk free therapeutic application. About 80% of populations worldwide rely on herbal medicines for their primary healthcare requirements. Adverse effects associated with herbal medicines may result from contamination of products with toxic metals; adulteration, misidentification, substitution of herbal ingredients or improperly processed or prepared products. Unani medicine is recognized as one of the safest systems of medicine because the drugs used in this system are prepared after using different procedures of purification and detoxification. Therefore commonly it is believed that Unani drugs do not produce any major side effects. However, the possibility of contamination of herbal medicine with toxicants by absorbing heavy metals from soil, water and air cannot be denied. Usually soil is subjected to contamination through atmospheric deposition of heavy metals from different industrial activities. Additional sources of these elements for plants are rainfall, atmospheric dusts and plant protecting agents. Toxic elements from waste water may contaminate agricultural soil, water and environment. Finally these toxicants enter the human body and may disturb its normal functioning and cause a number of serious side effects such as hepatotoxicity, carcinogenicity and immune-suppression etc. Therefore, it has been made mandatory to ascertain that these agents are not exceeding the permissible limits in test drug. QZ in the present study was found safe because aflatoxins, pesticide residues were not detected at all in the test sample, whereas the bacterial load was found to be many folds lower than their permissible limits. Similarly the heavy metals were also found within the permissible limits. The findings indicated that the test drug is quite safe and can be used effectively in the management of diseases. The study provides one of the earliest reports about the safety of QZ. The individual ingredients and to some extent the composition has been studied earlier for various pharmacological and standardization related profiling. By providing the data regarding its safety profile the drug can now said to be effective and safe and can be used therapeutically without a fear of serious toxicity.

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Physico-chemical and Phyto-chemical Analysis of Market Sample of Banafshah (*Viola odorata* Linn.)

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Abstract

Present study provides an updated standardization profile of market sample of a well known Unani drug Banafshah (*Viola odorata* Linn.) used for its efficacy in bilious affections, lung troubles, kidney diseases, liver affections, in fevers and as blood purifier. A review of literature, revealed that only few pharmacopoeial parameters like total ash value, acid insoluble ash, alcohol soluble and water soluble extractives, thin layer chromatography (TLC) of petroleum ether extract are reported in the Unani pharmacopoeia. These known parameters were matched with the market sample of Banafshah and were found to be within range with slight acceptable variation. However, data on water soluble ash value, sulphated ash value, extractive value in different solvents, organoleptic features, moisture content, bulk density, melting range, pH value, total alkaloid content, crude fiber content, qualitative analysis, phyto-chemical analysis with different reagents, IR spectral studies, FTAR analysis of different extracts, TLC of other extracts are unreported. These parameters were investigated by us for the first-time as per the pharmacopoeial guidelines. This communication provides updated pharmacopoeial parameters of Banafshah that will help to match its future market samples for evaluation of their identity and purity so as to have uniform therapeutic efficacy of manufactured products.

Keywords: Banafshah (*Viola odorata* Linn.), Standardization, Pharmacopoeial guidelines

Introduction

Standardization of bio-resources is mandatory to ensure their identity, quality, safety and efficacy for their proper use in health ailments; this is a very important in present scenario where there is highly increasing trend of utilizing medicinal plants specifically in developing countries, where they are accepted due to their safety, efficacy, cultural acceptability and lesser side effects (Kamboj, 2000). It is more specific for the traditional medicines which are based on natural drugs as Ayurveda, Unani, Siddha and Homeopathy (AYUSH) medicine. Diverse biological flora and fauna; geographical and climatic diversity provide us with variety of different species of same plant at a time collected from different places; moreover change in the environmental condition of a place after a regular interval of time also lead to difference in their quality. So there are upmost chances of variation in their physicochemical or phytochemical parameters that also affect their therapeutic efficacy and provide a very strong reason behind non-uniform results in pharmacological effect of same plant nowadays.

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To ensure the authenticity and quality of pharmaceutical material used in Unani formulations, Central Council for Research in Unani Medicine (CCRUM) (Anonymous, 2006) and Ministry of AYUSH in the Unani Pharmacopoeia of India (Anonymous, 2007) has laid down standardization profile monographs of Unani drugs along with the standard methods to evaluate the physic-chemical and phytochemical profile as per Drugs and Cosmetic Act, 1940.

The present study was carried out with a view to analyze physico-chemical and phyto-chemical parameters of a well known Unani drug –Banafshah (*Viola odorata* Linn.) collected from the local area of Kashmir (where it is said to be of the best quality as per literature, and is supplied throughout the country for consumption) (Ghani, 1921) and were matched with standards available in Unani pharmacopoeia while many new parameters which are not reported earlier were done as per the guidelines available to ensure its uniform quality. The attempt is to present an updated standardization profile of this important drug to help ISM drug manufacturers to produce quality medicine.

Review of literature

Viola odorata Linn. (Family-Violaceae) - a glaborous or pubescent perennial herb about 10-15 cm in height arising from short stout rootstocks, leaves are in radial/terminal tufts with bluish purple or white flowers borne singly on axillary peduncles, scented, tastes nauseous, bitter and mucilaginous (Anonymous, 2006). Commercially plant and flowers are used in medicine (Dymock, 1890; Khory and Katrak, 1985) while the native healers consider the purple flowered variety to be the best; they use the flower separately and also the entire plant (Dymock, 1890) and both are sold in the market in the name of 'banafshah'. Native of Kashmir and temperate western Himalaya, found at an altitude of 1500-1800 m, above 5000 ft., distributed over north and west Asia, North Africa, Europe, Nepal, Mishmi, and Khasi hills and China (Anonymous, 1976). *V. odorata* from Kashmir is considered to be of finest in quality (Ghani, 1921), which is often planted. In northern India *Viola cineria* Bioss. and *Viola serpenes* Wall. are used as substitute for *Viola odorata*, and are called as Banafshah (Dymock, 1890) and commercial drug available in the Indian market is generally highly adulterated with other *Viola* spp. as *V. biflora, V. canescens, V. cinerea, V. pilosa, V. sylvestris* (Anonymous, 1976).

Ethnopharmacological Reports: Flowers are astringent, demulcent, diaphoretic, diuretic, laxative, refrigerant and expectorant (Nadkarni, 2000); flower and leaves are used in bilious affections, lung troubles, prolapse of the rectum and uterus and in restraining suppuration, kidney diseases, for calculous affections and liver affections, fevers, syphilis, skin diseases, chronic diarrhoea and dysentery (Anonymous, 1976; Farooq, 2005; Khory and Katrak, 1985; Pandey and Chadha,

1996; Sharma, 2003). It is also used as blood purifiers (Bhattacharjee and De, 2005; Chopra *et al*., 1958; Farooq, 2005; Sharma, 2003). The herb shows antimycotic and antibacterial activity, and is considered quite effective in the treatment of eczema (Kiritikar and Basu, 1996).

Use in Traditional medicine: The literature review undertaken on the test drug Banafshah reveals that the drug has been traditionally used in many diseases as in bilious affections, lung troubles, prolapse of the rectum and uterus, kidney diseases, liver affections, in fevers and as blood purifier (Attar, 1888; Ghani, 1921; Ibne Sina, 1887; Ibne Baitar, 1885; Khan, 1892; Hakeem, 2002). Present study is an attempt to provide standardization profile of a market sample of banafshah matched with the standards available and to explore those which are not existing but are necessary, as per pharmacopoeial guidelines and could be set as standard. The study was done in Department of Ilmul Advia, A.M.U., Aligarh in the year 2009-2010.

Material and Methods

Plant Material: Dried herbal material of Banafshah (*V. odorata* Linn.) was procured from the local market of Kashmir and botanically identified with available literature and then confirmed by Prof. S.H.Afaq in Pharmacognosy Section. A herbarium sample (Voucher No. SC-0099/09-V) was prepared and submitted in the museum of the Department of Ilmul Advia for future reference. Leaves and flowers were handpicked to remove them from debris material that includes some sandy material and wood pieces (Fig.1). They were washed with DDW and dried at room temperature in a ventilated room, milled to coarse powder and stored in a close air tight container in dark until use. Strict aseptic precautions were followed throughout the process.

Physico-chemical analysis: The analysis include the study to determine ash value, melting point, moisture content, pH value at 1% and 10% solution, solubility, bulk density, loss on drying (Jenkins *et al*., 1967; Anonymous, 1968; Anonymous, 1970; Afaq *et al*., 1994).

Phytochemical analysis: The analysis include the determination of the extractive values in different organic solvents, qualitative analysis of the chemical constituents present in the drug sample, Fluroscence Analysis of the powdered drugs and successive extracts (FTAR Analysis), crude fiber content, alkaloid estimation, Thin Layer Chromatography (TLC) (Jenkins *et al*., 1967; Anonymous, 1968; Anonymous, 1970; Afaq *et al*., 1994; Peach *et al*., 1955).

Statistical Analysis: Results are expressed as Mean, Standard error of Mean with Standard deviation. All the tests done were carried out in triplicates in standard laboratory conditions following the guidelines of Good Laboratory Practices (GLP).

Results

Correct identification and quality assurance of the raw material is an essential prerequisite to ensure reproducible quality of herbal medicine, which contributes to its safety and efficacy. So, standardization of the selected market sample of Banafshah was done as an up most criterion of our study. As the efficacy of many drugs mainly depends upon its physical and chemical properties therefore, the determination of physico-chemical characters for the authenticity of a drug is necessary before studying any medicinal property. These studies of any phyto drugs are necessary for standardization, as it helps in understanding the significance of physical and chemical properties of the substance being analyzed in terms of their observed activities and especially to the determination of the purity and quality of the drugs and chemicals official to it as in National Pharmacopoeia. It is also more important, because it helps in characterization of constituents or group of constituents that frequently lead to establish the structure-activity relationship and the likely mechanism of action of the drug. Phyto-chemical constituents present in the drug vary, not only from plant to plant but also among different samples of same species, depending upon various atmospheric factors, storage and drying conditions; a little deviation from the normal in terms of quality and quantity of the constituents may alter the effect of drug. Apart from the degradation in the quality of the drugs that occurs due to above conditions, adulteration also contributes to variability. Thus, keeping in view the above consideration, physico-chemical studies on the drug under study were carried out to characterize the drug sample for the future reference. Organopleptic features are presented in Table-1.

Parameters used for the physico-chemicals study of the test drugs were: (i) Ash value; (ii) Moisture Content; (iii) pH value; (iv) Melting range; (v) Solubility; (vi) Bulk density; (vii) Crude fiber estimation; (viii) Alkaloid estimation. Results are expressed as Mean value in Table-2.

Parameters used for the phyto-chemicals study of the test drugs were: (i) Extractive value (Table-2); (ii) Qualitative analysis of the phyto-chemicals (Table-3); (iii) Fluorescence Analysis of Powdered drugs (Table-4); (iv) Fluorescence Analysis of the Successive extracts of the test drug (Table-5); (v) IR Spectral Analysis of the test drugs (Table-6); (vi) Thin Layer Chromatography (Table-7).

Fresh sample - *V.odorata*

Parts Used - *V. odorata*

Market sample- *V. odorata*

Fig.1: Banafshah (*Viola odorata* Linn.)

Day Light

UV Short

TLC Banafshah - Petroleum ether extract

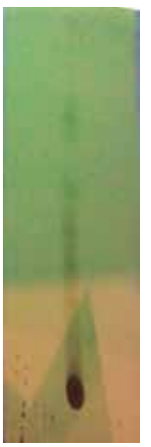
Iodine Vapour

UV Long

TLC Banafshah - Chloroform extract

Day Light

Iodine Vapour



UV Long

UV Short

TLC Banafshah- Ethanolic extract

Fig 2: Thin Layer Chromatography of Banafshah (Viola odorata Linn.)

Table 1: Organoleptic Characters of Banafshah (Viola odorata Linn.)

Parameters	Banafshah
Colour	Dark Green
Smell	Odourless
Taste	Slightly Bitter

Table 2: Physicochemical study of market sample of Banafshah

S. No	Parameters		*V.odorata* Linn. (Violaceae) Mean ± S.E.M. (S.D) (Market Sample)	*V.odorata* Linn. (Violaceae) (Percentage / Gram) (CCRUM, 2006)	*V.pilosa* Blume. (Violaceae) (Percentage / Gram) (UPI, 2007)
1	Percentage of Ash Value (w/w)	Total Ash	11.24 ± 0.01(0.02)	Not more than 14.25%	Not more than 13%
		Acid Insoluble Ash	3.15 ± 0.00(0.01)	Not more than 1.7%	Not more than 3%
		Water Soluble Ash	2.35 ± 0.07(0.19)	-------	-------
		Sulphated Ash	0.59 ± 0.02(0.05)	-------	-------
2	Moisture Content (v/w)	Loss of weight on Drying at 1050C	12.28 ± 0.01(0.02)	-------	-------
		Toulene Distillation Method	12.60 ± 0.01(0.02)	-------	-------
3	pH Value	1% solution	7.05 ± 0.01(0.02)	-------	-------
		10% solution	6.52 ± 0.01(0.02)	-------	-------
4	Solubility (% in w/w)	Alcohol Soluble	18.49 ± 0.02(0.04)	Not less than 5.25%	Not less than 2%
		Water Soluble	26.72 ± 0.02(0.04)	Not less than 18.31%	Not less than 11%
5	Extractive Value (% in w/w)	Petroleum Ether	1.69 ± 0.02(0.05)	-------	-------
		Diethyl Ether	0.85 ± 0.02(0.03)	-------	-------
		Chloroform	0.76 ± 0.01(0.03)	-------	-------
		Ethanol	9.53 ± 0.32(0.56)	-------	-------
		Aqueous	11.88 ± 0.28(0.49)	-------	-------
6	Melting Range		102-1200C	-------	
7	Bulk Density (% in w/w)		0.54 ± 0.01(0.02)	-------	
8	Crude Fiber Content (% in w/w)		7.33 ± 0.01 (0.02)	-------	
9	Total Alkaloid estimation (% in w/w)		6.04± 0.08(0.01)	-------	

Table 3: Qualitative Analysis of the Phytochemicals

S.No	Chemical Constituents	Test Reagents	Banafshah
1.	Alkaloids	Dragendorff's reagent	+
		Wagner's reagent	+
		Mayer's reagent	+
2.	Carbohydrates	Molish Test	+
		Fehling Test	+
		Benedict Test	+
3.	Flavonoids	Mg Ribbon and dil. Hcl	+
4.	Glycosides	NaOH Test	+
5.	Tannins/Phenols	Ferric Chloride Test	+
		Liebermann's test	+
		Lead Acetate test	+
6.	Proteins	Xanthoproteic test	_
		Biuret test	+
7.	Starch	Iodine Test	_
8.	Saponnins	Frothing with NaHCO3	+
9.	Steroids/Terpenes	Salkowski Reaction	+
10.	Amino acids	Ninhydrin Solution	+
11.	Resins	Acetic anhydride test	+

Indications: '_'Absence and '+' Presence of constituents

Table 4: Fluorescence Analysis of the Test Drugs with chemicals of Banafshah

S.No.	Powdered drug	Day Light	UV Short	UV Long
1.	P. drug + Con. HNO_3	Light Orange	Light Green	Green
2.	P. drug + Con. Hcl	Dark Green	Light Green	Light Green
3.	P. drug +Con. H_2SO_4	Dark Brown	Black	Black
4.	P. drug +Iodine sol. (5%) in alcohol	Gold Brown	Brownish Green	Black
5.	P. drug + Glacial Acetic acid	Green	Green	Black
6.	P. drug + Gl. Acetic acid+ HNO_3	Green	Green	Dark Green
7.	P. drug + NaOH Solution (10%)	Dark Green	Dark Green	Black
8.	P. drug +10%NaHO+Concn HNO_3	Brown	Dark Green	Very dark Green
9.	P. drug +dilute HNO_3	Green	Dark Green	Black
10.	P. drug + dilute H_2SO_4	Dark Green	Dark Green	Black

S.No.	Powdered drug	Day Light	UV Short	UV Long
11.	Powdered drug + dilute Hcl	Dark Green	Green	Black
12.	P. drug + Drangendorff reagent	Brownish Green	Dark Green	Black
13.	P. drug +Wagner's reagent	Dark Green	Brownish Green	Dark Green
14.	P. drug + Benedict's reagent	Dark Green	Bright Green	Dark Green
15.	P. drug + Fehling Reagent	Very Dark Green	Dark Green	Dark Blue
16.	P. drug + KOH (10%) methanolic	Very Light Yellow	Green	Dark Green
17.	P. drug +$CuSO_4$ (5%)	Light Green	Dark Green	Black
18.	P. drug + Ninhydrin (2%) in acetone	Dark Green	Dark Green	Black
19.	P. drug + Picric acid	Light Green	Light Green	Green
20.	P. drug + Lead Acetate (5%)	Dark Green	Light Green	Black

Table 5: Fluorescence Analysis of the successive extracts of Banafshah

Extracts	Day Light	UV Short	UV Long
Petroleum ether	Brown	Light Green	Dark Brown
Diethyl ether	Dark Green	Dark Brown	Black
Chloroform	Black	Green	Dark Black
Alcohol	Brown	Green	Greenish Brown
Aqueous	Brown	Dark Green	Black

Table 6: IR Spectral Details of Alcoholic Extract of Drug

Test Drug	IR, υ (cm-1)
Banafshah	3463.19, 2930.35, 2365.70

Table 7: Thin Layer Chromatography of Banafshah

Extract	Solvent System	Treatment	Visualizing Agent	No. of Spots	Rf value
Petroleum ether	Benzene: Chloroform (8:2)	I2 Vapour	Day Light	3	0.06, 0.10, 0.20
			UV Long	3	0.06, 0.10, 0.20
			UV Short	1	0.10(G)
	Petroleum ether: ether (8:2)	”	Day Light	4	0.07, 0.15, 0.53, 0.61
			UV Long	3	0.07, 0.53, 0.61
			UV Short	1	0.53(D.G)

Extract	Solvent System	Treatment	Visualizing Agent	No. of Spots	Rf value
Chloroform	Benzene : Chloroform (4:1)	I2 Vapour	Day Light UV Long UV Short	1 2 1	0.08 0.13 0.13(L.G)
	Chloroform: Methanol (3:7)	”	Day Light UV Long UV Short	1 4 5	0.41 0.33. 0.5, 0.75, 0.83 0.50 (G), 0.54(D.G), 0.63(L.G), 0.83(G), 0.90(D.G)
Alcohol	Toulene: Ethyl acetate : Benzene : Acetic acid (4:1:2:2 drops)	I2 Vapour	Day Light UV Long UV Short	6 6 5	0.23, 0.30, 0.35, 0.38, 0.49, 0.52 0.23, 0.30, 0.35, 0.38, 0.49, 0.52 0.30(L.Br.), 0.35(Br.), 0.38(Br.), 0.49(G), 0.52(L.G)
	Benzene: Ethyl acetate: Di ethyl ether	”	Day Light UV Long UV Short	1 1 1	 0.54, 0.63 0.54 0.54(D.Br.)

Discussion

Standardization is considered as a prerequisite for any phyto-drug to assess its biological activity or determination of biological standards of the herbal material that provides the analytical characteristics which may prove to be useful in fixing the physicochemical standard.

In the present study it was observed from the descriptions available in Unani pharmacopoeia of India (2007) that the drug mentioned under the name of Banafshah is botanically a different species i.e. *Viola pilosa* of Violaceaeae family where they have mention of leaves of Banafshah, so it is obvious that the standard parameters available in UPI (Anonymous, 2007) are just for identity of leaves; and in our analysis of market sample (MS) of *V.odorata* , we have taken leaves and flowers of Banafshah , so there are upmost chance of slight variation and which are obvious due to change in species of the drug, but still it was seen that the variation was not so large or may be said to be none, as according to UPI (2007) total ash value /gm of the drug should not be more than 13% , and in MS it was of 11.24% . Similarly in acid insoluble ash value UPI (2007) report it to be not more than 3% and in MS it was found to be 3.15%. Other parameter for identification measurement was of solubility in UPI (2007); that alcohol solubility should not be less than 2% and water solubility to be not less than 11% and

in MS alcohol solubility was 18.49% and water solubility 26.72%, i.e as per the range of UPI, 2007. So, in spite of a different species and flowers combined in our drug sample the difference is not there in two different species or the study may also be taken as that when leaves and flowers both are used the values of above mentioned parameters should be as available in the present study.

And when these results are compared with other works of Ministry of AYUSH in Central Council for Research in Unani Medicine (Anonymous, 1992; Anonymous, 2006), it was observed that the drug sample mentioned is of same species i.e. *V.odorata*, but in that also the analytical parameters that are mentioned are for leaves of Banafshah. Total ash value mentioned for same species is not more than 14.25% , and in MS it was found to be 11.24% (below 14.25%) and acid insoluble ash is reported in Council research work is that it should not be more than 1.7%, and in MS it was 3.15% (above from 1.75%) that is a difference in the acid insoluble value. However alcohol solubility mentioned is not less than 5.25% and water solubility as 18.31% and in MS alcohol solubility was found to be 18.49% (i.e. above 5.25%) while aqueous solubility as 26.72% (above 18.31%). So, the same species is matched with this work, and can be taken as more approachable sample of Banafshah to match with the standard. And it was observed that market sample of Banafshah studied for physio-chemical and phytochemical analysis is of standard quality and authentic.

Conclusion

Sample of Banafshah available in the market is of standard value in terms of its physico-chemical and phyto-chemical standards as per the pharmacopoeial guidelines with a slight variation, as matched with reported parameters available for its identity and purity. Some new parameters were also studied that are not mentioned in the pharmacopoeia and reported for the first time viz., FTAR Analysis, IR Spectral study. Additional standardization parameters may supplement the existing parameters and provide a roadmap for further research analysis of 'Banafshah' to check for its identity and purity so as to have genuine, authentic, safe drug with uniform pharmaceutical efficacy (Shariq, 2008).

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A Contribution to the Ethnomedicinal Flora of Chakrata Forests in Dehradun District, Uttarakhand#

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Abstract

An ethnobotanical survey of the Chakrata forests in Dehradun district of Uttarakhand has yielded useful information on folk medicinal claims prevalent among the tribal communities, dominated by Jaunsar-Bawar. Based on this field study carried out during November 2014 and March 2017, the present paper deals with 55 species belonging to 51 genera and 34 families that are commonly used as folk drugs for treatment of various humans and cattle diseases and conditions. For each plant species the current botanical and prevalent local names, the part used, claimed medicinal use(s) and manner of using the crude drugs are provided. This report lists many new phytotherapeutic applications and preparations from the area surveyed.

Key Words: Ethnobotanical survey, Folk medicine, Chakrata forests, Dehradun, Uttarakhand.

Introduction

The Chakrata forest division (30˚ 26´-31˚ 02´ N latitudes and 77˚ 38´-78˚ 04´ E longitudes) forms a part of Dehradun district in Garhwal Himalayas. The entire division is a highly mountainous region located between the upper courses of river Yamuna and Tons. In major part of the year, many areas at higher elevations remain under snow cover. The area has mainly a temperate type of vegetation. Forests of this division are very rich in floristic diversity. It is a homeland of some primitive communities dominated by Jaunsar-Bawar. This particular region was selected for an extensive ethnobotanical survey of the medicinal plants because it is remote from the industrial centres and possesses interesting climate, landscape and varied flora (Agarwal, 1959; Chand and Yadav, 1970; Chandra *et al*., 2010; Cheema *et al*., 2014; Kanjilal, 1911; Singhal *et al*., 1986). Moreover, available ethnobotanical publish reports were encouraging (Bartwal and Chandra, 2010; Bartwal *et al*., 2011; Bhatt and Negi, 2006; Bist and Pundir, 2008; Chandra and Meenakshi, 2010; Chantia, 2003; Dobhal *et al*., 2007; Jain and Puri, 1984; Joshi and Joshi, 2011; Kumar and Pandey, 2015; Neelam *et al*., 2009, 2010; Rana and Datt, 1997; Rawat *et al*., 2009; Singh and Pundir, 2004; Singh, 1997; Singh *et al*., 1984). In this communication, an enumeration of the plants of ethnomedicinal utility is presented. The study represents a contribution on our existing knowledge on ethnomedicinal flora of this part of Garhwal Himalayas, Uttarakhand.

Methodology

The study area was surveyed in November 2014 and March 2017. During the course of fieldwork, a number of tribal settlements located in different forest ranges viz. Kanasar, Devghar, Rickhanar, Babar and Molta were visited and

Feature Article

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data were obtained by interviewing local healers and other knowledgeable village elders. The information collected includes local name, claimed medicinal use(s), part used, other ingredients added (if any), method of preparing the medicine and mode of administration. Plant specimens were collected and identified by the senior author with the help of pertinent floras (Babu, 1977; Gupta, 1928; Naithani, 1984-1985) and nomenclature was updated according to a recent work on flowering plants of Uttarakhand (Uniyal *et al*., 2007). All voucher specimens were prepared and deposited in the herbarium of the Survey of Medicinal Plants Unit, Regional Research Institute of Unani Medicine, Aligarh (UP), India.

Enumeration

In the following listing, plants are arranged in alphabetical order by their botanical name together with respective family between parentheses, local name, locality and voucher specimen number, followed by claimed medicinal use(s) and mode of administration. As far as possible, doses and duration of these crude drugs are also given.

Aconitum heterophyllum Wall. ex Royle (Ranunculaceae), 'Atis', Deoban (ZAA 10454). A small piece of fresh root is chewed for stomach-ache. Higher dose of the drug may be poisonous.

Acorus calamus L. (Araceae), 'Bach', Deoban (ZAA 10455). Dried rhizome is tied as an amulet around neck of the child suffering from worm infestation.

Ageratina adenophora (Spreng.) R.M. King & H. Rob. (Asteraceae), 'Kalabansa'/'Bushiyan', Gouraghati (ZAA 10415). Fresh leaves are washed and squeezed to obtain the juice. It is applied on cut to stop the bleeding.

Ainsliaea aptera DC. (Asteraceae), 'Kadu', Deoban (ZAA 10405). Leaf decoction is given orally to allay fever in pneumonia while fresh root is chewed for instant relief in abdominal pain due to flatulence.

Ajuga parviflora Benth. (Lamiaceae), 'Neelkanthi', Chakrata (ZAA 9795). A freshly made paste of the leaves, obtained by crushing, is applied externally on the body for general swelling.

Allium consanguineum Kunth (Liliaceae), 'Van Lehsan', Deoban (ZAA 10456). A paste, obtained by crushing the bulbs, is applied on knee for treating pain.

Artemisia roxburghiana Wall. ex Besser (Asteraceae), 'Chhamru', Chakrata (ZAA 9756). Aqueous decoction of dried leaves is given to treat stomach-ache.

Artemisia vulgaris L. (Asteraceae), 'Paati', Chakrata (ZAA 9852). Root decoction is administered orally against flatulence.

Berberis asiatica Roxb. ex DC. (Berberidaceae), 'Kashmoi', Deoban (ZAA 10345). Dried root piece is soaked overnight in water; the infusion thus obtained is given once daily in the morning to control diabetes. Prolong use of this drug damages kidney.

Berberis chitria Buch.-Ham. ex Lindl. (Berberidaceae), 'Kingor', Deoban (ZAA 10018). Sap of fresh root is instilled in the eyes for redness.

Bergenia ciliata (Haw.) Sternb. (Saxifragaceae), 'Pattharchoor'/'Silphora', Deoban (ZAA 10399). For treatment of piles, leaves are cooked and taken daily as pot herb. Simultaneously, root paste is given orally. Equal quantities of the root of 'pattharchoor', 'gokhru' (fruits of *Tribulus terrrestris* L., Zygophyllaceae), 'kulthi' (seeds of *Macrotyloma uniflorum* (Lam.) Verdc., Fabaceae) and 'sonf' (*Foeniculum vulgare* Mill., Apiaceae) are crushed together and two spoon of this preparation are given twice a day for one to two month to dissolve and expel small kidney stones.

Boenninghausenia albiflora (Hook.) Rchb. ex Meisn. (Rutaceae), 'Pissu', Chakrata (ZAA 9778). Leaf decoction is poured over the body of cattle to keep away ectoparasites.

Cedrus deodara (Roxb. ex D. Don) G. Don (Pinaceae), 'Deodar', Guswapul (ZAA 10368). Wood-oil is applied on scabies. It is also applied on the body of sheep to kill lice.

Crotalaria linifolia L. f. (Fabaceae), 'Pengiyara', Chakrata (ZAA 9863). Leaf paste is applied on cut and wounds for healing.

Daphne papyracea Wall. ex G. Don (Thymelaceae), 'Satpura', Deoban (ZAA 10392).Stem bark paste is applied on burns.

Debregeasia saeneb (Forssk.) Hepper & J.R.I. Wood (Urticaceae), 'Siar', Lakhamandal (ZAA 10430). Stem twigs are used as splints in bone fracture.

Digitalis purpurea L. (Scrophulariaceae), 'Tilpushpi', Deoban (ZAA 10447). Equal quantities of the leaves and roots are boiled in water and liquid strained. It is given for chest pain in cardiac problem.

Elaegnus rhamnoides (L.) A. Nelson (Elaeagnaceae), 'Ameesh Chook', Deoban (ZAA 10459). Fruit juice is given orally to reduce the risk of heart attack.

Ephedra gerardinia Wall. ex Stapf (Ephedraceae), 'Tootganth', Deoban (ZAA 10394). Leaf decoction is given to treat leucorrhoea.

Ficus neriifolia Sm. (Moraceae), 'Dudhla', Gouraghati (ZAA 10417). Fresh leaves are fed to cows for deficient lactation.

Gentiana kurroo Royle (Gentianaceae), 'Karwi'/'Tirayaman', Deoban (ZAA 10457). For treating urinary tract infection, the decoction of the chopped plant is administered orally two times a day for 7-10 days.

Gentiana tianschanica Rupr. ex Kusn. (Gentianaceae), 'Narbosa', Badrikhan (ZAA 9833). Root decoction is given for fever due to cold.

Geranium wallichianum D. Don ex Sweet (Geraniaceae), 'Raat Ninnai', Deoban (ZAA 9794). Leaf paste is applied externally on neck to treat tonsillitis.

Girardinia diversifolia (Link) Friis (Urticaceae), 'Karwakushka', Murthat (ZAA 9810).The root decoction is given orally to the women who is giving birth, the belief that it will facilitate delivery.

Grewia optiva J.R. Drumm. ex Burret (Tiliaceae), 'Bihu', Puna Pokhri (ZAA 10423). Fresh leaves are fed to cattle to treat the loss of appetite. These are also given to cow as galactagogue.

Hedychium spicatum Sm. (Zigiberaceae), 'Kapoor Kachri', Guswapul (ZAA 10458). Rhizome paste is applied on knee as poultice for joint pain and inflammation.

Juglans regia L. (Juglandaceae), 'Akhrot', Gouraghati (ZAA 10443). Fresh stem bark chewed to treat toothache.

Mahonia napaulensis DC. (Berberidaceae), 'Khoru', Gouraghati (ZAA 10357). Root sap is applied in the eye suffering from conjunctivitis.

Neolitsea umbrosa (Nees) Gamble (Lauraceae), 'Shrood', Deoban (ZAA 10451). The oil, extracted by crushing the dried seeds, is applied in the scalp with a light massage once daily to kill lice. This oil is often kept as households remedy and used as and when needed.

Picrorhiza kurrooa Royle (Scrophulariaceae), 'Kutki', Deoban (ZAA 9804). Root is crushed and boiled in water; the liquid is strained and given orally twice a day for one month for leucorrhoea.

Pinus wallichiana A.B. Jacks. (Pinaceae), 'Kail', Deoban (ZAA 10387). Paste of the stem bark mixed with little powdered alum is plastered around the fractured limb. Moreover, long pieces of the stem bark as splints and cotton bandages are used to hold the bones and plaster in position.

Platycladus orientalis (L.) Franco (Cupressaceae), 'Surai', Deoban (ZAA 10389). Cone is rubbed on stone with little water and the paste thus obtained is applied on burns.

Pouzolzia viminea Wedd. (Urticaceae), 'Panguri', Tuina (ZAA 9862). Leaf infusion is used as gargle for treating gingivitis.

Prunus cerasoides Buch.-Ham. ex D. Don (Rosaceae), 'Padam', Kanasar (ZAA 10461). Powder of the stem bark is boiled in water till it become semisolid and cooled. This is applied locally for muscular pain.

Punica granatum L. (Punicaceae), 'Darimb'/'Darmu', Lotakhand (ZAA 9855). Chopped stem bark is boiled in water and cooled. It is given two times a day for two week in jaundice. Long piece of the stem bark is rubbed with water on stone and given to children for cough. Inner portion of shell of the mature fruit is dried and ground to make a fine powder. One spoon of this is given with water once daily in the morning to control diabetes.

Pyrus pashia Buch.-Ham. ex D. Don (Rosaceae), 'Kaenth', Guswapul (ZAA 10354). Juice of the unripe fruit is instilled in injured eye of cattle for redness and healing.

Reinwardtia indica Dumort. (Linaceae), 'Pingli', Guswapul (ZAA 10366). Leaf paste is applied on cut for healing.

Rhododendron arboreum Sm. (Ericaceae), 'Burans', Deoban (ZAA 10336). Powder of the flower is snuffed in blood dysentery.

Rubia cordifolia L. (Rubiaceae), 'Charchara', Guswapul (ZAA 10371). Leaf paste is applied locally on scorpion sting to reduce stinging pain. It is also applied on bite point of other poisonous insects.

Rumex hastatus D. Don (Polygonaceae), 'Almoru', Chakrata (ZAA 10334). Leaf paste is applied on boil to speed up suppuration and healing.

Sapindus mukorossi Gaertn. (Sapindaceae), 'Reetha', Tuini (ZAA 10462). Paste of the fruit pulp is applied on alopecia.

Sarcococca pruniformis Lindl. (Buxaceae), 'Tiliari', Deoban (ZAA 10393). Root bark is ground with water and applied on abscesses of male genitalia.

Saussurea costus (Falc.) Lipsch. (Asteraceae), 'Kuth', Deoban (ZAA 10463). Crushed leaves are boiled and beverage drunk to relieve asthma. This preparation also claimed effective in the treatment of anuria.

Senecio nudicaulis Buch.-Ham. ex D. Don (Asteraceae), 'Neelkanth', Deoban (ZAA 10448). Leaf paste is applied on old wound for healing.

Sinopodophyllum hexandrum (Royle) T.S. Ying (Berberidaceae), 'Ban Kakri', Deoban (ZAA 10460). Root paste is given orally for uneasiness and stomach-ache.

Swertia chirayita (Roxb.) H. Karst. (Gentiaceae), 'Chirata', Murthat (ZAA 10416). Decoction of the whole plant is given to allay fever of pneumonia, typhoid and malaria.

Swertia ciliata (D. Don ex G. Don) B.L. Burtt (Gentianaceae), 'Chirata', Vyas Shikhar (ZAA 9763). Leaf powder is boiled in water and liquid is strained. It is given to treat common fever.

Taxus baccata L. (Taxaceae), 'Thuner', Deoban (ZAA 10397). Paste of the stem bark is applied externally on cyst of breast.

Thalictrum foliolosum DC. (Ranunculaceae), 'Sopau', Deoban (ZAA 10411). Roots are ground and made into pills of pea size each with 'gur' (solidified sugarcane juice); about five pills are given with water twice daily for two week to activate liver after jaundice.

Thymus linearis Benth. (Lamiaceae), 'Banajwain', Deoban (ZAA 10408). Paste of the whole plant is given orally to treat chest pain due to excessive gases.

Tinospora glabra (Burm. f.) Merr. (Menispermaceae),'Gilo', Deoban ZAA 10460). Paste of the stem-bits is mixed with traditional buttermilk and applied locally on mammary glands of cows in skin allergy.

Urtica doica L. (Urticaceae), 'Kandali', Puna Pokhri (ZAA 10422). Leaf paste is applied on wound for healing in cases of children.

Urtica parviflora Roxb, (Urticaceae), 'Karwakushka', Deoban (ZAA 9809). Wilted plants are fed to cows for deficient lactation.

Viola pilosa Blume (Violaceae), 'Benaksha', Guswapul (ZAA 10332). Two spoonful decoctions of aerial parts are given to infants to treat catarrh and cold.

Zanthoxylum armatum DC. (Rutaceae), 'Timur', Kuansi (ZAA 10428). Fruit paste is put on aching tooth.

Some Folk Medicinal Plants of the Study Area

Fig. 1. *Bergenia ciliata* (Haw.) Sternb.

Fig. 2. *Daphne papyracea* Wall. ex G. Don

Fig. 3. *Debregeasia saeneb* (Forssk.) Hepper & J.R.I. Wood

Fig.4 *Gentiana kurroo* Royle

Fig. 5. *Mahonia napaulensis* DC.

Fig. 6. *Reinwardtia indica* Dumort.

Fig. 7. *Rhododendron arboreum* Sm.

Fig. 8. *Rubia cordifolia* L.

Fig. 9. *Sarcococca pruniformis* Lindl.

Fig. 10. *Zanthoxylum armatum* DC.

Results and Discussion

This report documents some traditional and contemporary knowledge of the medicinal use of plants employed by the indigenous communities of Chakrata forests. A total of 55 plant species belonging to 51 genera and 34 families were recorded for curing or alleviating various diseases and conditions viz. abscess and boils, alopecia, anuria, asthma, blood dysentery, bone fracture, burns, cold, diabetes, fevers, flatulence, jaundice, joint pain, kidney stones, leucorrhoea, muscular pain, piles, scabies, scorpion-sting, stomach-ache, tonsillitis, worm infestation, and many complaints of domestic animals. The data are authentic and based on direct field interviews of reliable informants who have sound knowledge of herbal remedies. These ethnomedicinal uses were compared with the pertinent literature (Agarwal, 1986; Ambasta, 1986; Anonymous, 2001; Chopra *et al*., 1956; Jain, 1991; Kirtikar and Basu, 1935; Nadkarni, 1954) and it was found that uses of many plant species were similar and reported in the literature. Furthermore, many phytotherapeutic applications coincide with those of other parts of Dehradun (Ali *et al*., 2015, 2016a, 2016b; Bisht and Bhatt, 2012; Deoli *et al*., 2014; Gairola *et al*., 2013; Gaur *et al*., 2010; Maheshwari and Singh, 1992; Negi *et al*., 1992; Pant and Sharma, 2010; Rawat and Bhatt, 2002; Sharma *et al*., 1979, 2017; Sharma and Painuli, 2011; Singh *et al*., 1989, 2008, 2014; Upadhyay, 2014, etc.). Uses of other plants seem to be new or imperfectly known. All such medicinal uses suggested by these elderly people seem to be reliable and deserve further scientific investigations for their toxicity, effectiveness and safe medicinal usage.

It was emphatically noted during the current survey that some important wild medicinal plants have become scarce in the area due to illegal and continued over exploitation as well as habitat destruction. Similarly, local traditional medicine men now represent a disappearing tradition because the younger generation is not interested to learn their traditional phytotherapy. Moreover, Primary Health Care Centres are now accessible to the rural populace. So, gradually this art of folk medicine is disappearing with every passing day. It is, therefore, desirable to conduct survey of other ethnobotanically important areas of the state before this traditional knowledge is lost permanently with the ever dwindling number of folk medicine men, the rapid devastation of natural plant habitats and cultural changes among the tribal communities due to the effect of modernization. Through such observations, based on properly designed field studies, many more reliable folk medicinal uses of plants may be revealed which may yield useful leads needed in the search of newer and potent pharmaceuticals of plant origin for wide application.

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Physico-chemical Standardization of *Habbe Kafoori:* A Unani Formulation

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Abstract

Habbe Kafoori (HK pills) is a pharmacopoeal compound Unani preparation mainly used in patients of pyrexia of different etiology. Many pharmaceutical companies prepare it for commercial supply but they frequently fail to maintain the desired standards of its quality. In the present study HK has been studied on a number of physicochemical parameters to set its physicochemical standard. The parameters include organoleptic characters, weight variation of pills, uniformity in diameter, hardness test, friability test, pH, moisture content, loss of weight on drying, ash values, water and alcohol soluble matter, extractive values, Thin Layer Chromatography (TLC) and total alkaloid estimation. The findings of the study may be used as a reference for future studies and also to test the drugs available in the market for their quality and expected biological activity.

Keywords: Organoleptic, Thin Layer Chromatography, Alkaloidal estimation.

Introduction

Habbe Kafoori (HK) is an important drug of Unani system of medicine commonly used in the management of *Hummiyate Moharraqa, Humma Diqe Mewi* and other fevers of diverse etiology (Anonymous, 2006). It is a pharmacopoeal drug (pills) which is prepared by physicians and pharmacists and also by pharmaceutical units for large scale supply. Since the agents intended to be used for therapeutic purposes are studied for their safety and efficacy in order to ensure their quality and expected pharmacological and therapeutic effect therefore, it is mandatory to test such agents on physicochemical parameters to set their standards of quality. Standardization is considered essential for herbal drugs and their formulations in order to assess their quality. Since there are chances of variation in different batches of medicine it is imperative to establish a system of standardization for every plant product in the market.

If the physico-chemical standards are ensured then there are greater chances that the drug is effective therapeutically and its different samples will produce uniform degree of effect. Since *Habbe Kafoori* has been not been studied thoroughly for its physicochemical standards therefore in the present study it was prepared according to the methods described in Unani pharmacopoeal literature and studied on various physicochemical parameters including ash value, moisture content, pH of 1% and 10% solutions, pill friability, hardness and TLC etc. The findings will help in determining the quality of the test drug available in the market and set the standard for a genuine preparation.

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Materials and Methods

Unani poly herbal formulation *Habbe Kafoori* (Anonymous, 2006) was prepared according to the method described in national formulary. It was then studied on certain physicochemical parameters.

Ingredients

Kafoor (*Cinnamomum camphora*) 3 g, Tabasheer (*Bambusa arundinacea*) 5 g, Nishasta (*Triticum sativum*) 5 g, Sandal Safaid (*Santalum album*) 5 g, Maghze Tukhme Kadu (*Lagenaria siceraria*) 5 g, Kateera (*Cochlospermum gossypium*) 5 g, Luabe Behidana (*Cydonia oblonga*) Q.S

Procurement of crude drugs

The ingredients of HK were procured from an authorized single drug dealer in Bangalore. Unani experts including the supervisors of the study at National Institute of Unani Medicine (NIUM), Bangalore identified the crude drug samples. A Voucher specimen (No. 21/IS/Res./2014) has been deposited in the museum of NIUM.

Physicochemical studies

Physicochemical studies included (i) Organoleptic characters of the huboob such as appearance, colour, smell, texture, taste (ii) Weight variation (iii) Uniformity in diameter (iv) Hardness test (v) Friability test (vi) pH value (vii) Moisture content (viii) Loss of weight on drying (ix) Ash values (x) Water and alcohol soluble matter (xi) Extractive values (xii) Total alkaloid estimation (xiii) Thin layer chromatography (TLC).

Organoleptic properties

Organoleptic evaluation refers to the evaluation of the formulation by colour, odour, taste and texture. These were evaluated according to the method recommended by Pandey *et al*. (2012).

Weight variation

Average weight of twenty randomly selected pills was determined then each pill was weighed singly. In each case the deviation from the average weight was calculated and expressed as percentage. The pills are considered within the range if not more than two pills are outside the limit of 5% (Anonymous, 2006; Lachman *et al*., 2013).

Uniformity of diameter

Three pills were picked randomly to measure uniformity of diameter individually by Vernier calliper and expressed in mm (Dandagi *et al*., 2006).

Hardness Test

Three pills were individually taken and tested for the hardness by the Monsanto hardness tester in terms of kg/cm (Lachman *et al*., 2013; William & Wilkins, 2011).

Friability Test

Friability of the pills was determined using Friability test apparatus (Roche's Friabilator). Pre weighed sample of pills was placed in the friabilator and was subjected to 100 revolutions. Pills were de-dusted using a soft muslin cloth and reweighed. The friability (*f*) was calculated by the formula

$$f = \left(1 - \frac{W}{W_0}\right) \times 100$$

Where, W is the weight of the pills before the test and W_o is the weight of the pills after the test (Lachman *et al*., 2013).

Determination of pH

pH value of 1% and 10% solution: One and ten gm of accurately weighed powder drug was dissolved in 100 ml of measured distilled water separately, filtered and pH was measured with a pH meter (Anonymous, 2006).

Moisture Content

Toluene distillation method was used for the determination of moisture content of the drug. 10 gm of powdered drug was taken in a flask and 75 ml of distilled toluene was added to it. Distillation was carried out for five hours. The volume of water collected in receiver tube was noted and the percentage of moisture was calculated with reference to the weight of the air-dried drug (Jenkins *et al*., 2008; Afaq *et al*., 1994).

Loss of weight on drying

Two gram of drug was taken in a Petri dish and was spread uniformly. It was heated at a temperature of 105ºC, cooled and weighed. The process was repeated till two consecutive weights were constant. The percent loss in weight was calculated with respect to initial weight (Anonymous, 2006; Afaq *et al*., 1994).

Ash Values

Total Ash: Two gm of dried powdered drug was incinerated in a silica crucible at a temperature not exceeding 450 ºC until free from carbon; cooled and weighed and the percentage was calculated with reference to air dried drug.

Acid insoluble Ash: Total ash was boiled with 25 ml of dilute hydrochloric acid for 5 minutes and insoluble matter was collected on an ash less filter paper washed with hot water and ignited at a temperature not exceeding 450 ºC and

weighed after cooling. The percentage of acid insoluble ash was calculated with reference to the air dried drug.

Water soluble Ash: Total ash was boiled with 25 ml of distilled water for 5 minutes. The insoluble matter was collected on an ash less filter paper, washed with hot water and ignited. The weight of insoluble ash was subtracted from the weight of the total ash, giving the weight of the water soluble ash. The percentage of water soluble ash was calculated with reference to air dried drug (Afaq *et al*., 1994; Anonymous, 2006; Anonymous, 2011).

Determination of water and alcohol soluble matter

Four gm of accurately weighed drug was placed in a glass stoppered conical flask. It was macerated with 100 ml of water and alcohol separately for 6 hours and was shook frequently, and then allowed standing for 18 hours, and filtered rapidly through a dry filter. 25 ml of the filtrate was transferred to a previously weighed and tarred flat-bottomed dish and evaporated to dryness on a water bath, then dried at 105 ºC for 6 hours, cooled in a desiccator for 30 minutes and weighed without delay. The percentage of water or alcohol soluble matter was calculated with reference to the amount of drug taken (Anonymous, 2011).

Determination of extractive values

Successive extractive value: Powdered pills were taken and subjected to successive extraction with different solvents viz. petroleum ether, alcohol and water, respectively. It was carried out by percolation in Soxhlet apparatus. The heat was applied for six hours on a heating mantle for each solvent. The extracts were filtered using filter paper and after evaporation of the solvents on water bath, the extractive values were determined with reference to the weight of drug (% w/w) (Anonymous, 2006).

Non-Successive extractive value: Powdered pills were taken and subjected to separate extraction with each solvent (% w/w) viz. alcohol and water and was carried out separately by percolation in Soxhlet apparatus. The heat was applied for six hours. The extracts were filtered using filter paper and after evaporation of the solvents on water bath, the extractive values were determined with reference to the weight of drug (Anonymous, 2006).

Alkaloidal estimation

Five gram of drug sample was weighed into a 250 ml beaker and 200 ml of 10% acetic acid in ethanol was added to it and allowed to stand for 4 hours. It was filtered and the extract was concentrated on a water bath to one-quarter of the original volume. Concentrated ammonium hydroxide was added drop by drop to the extract until the process of precipitation completed. The whole solution was allowed to settle; the precipitate was collected and washed with dilute ammonium

hydroxide and then filtered. The residue is the alkaloid, which was dried and weighed (Suthersingh *et al*., 2011).

Thin layer Chromatography

Thin layer chromatography was carried out on TLC pre coated aluminium plates with silica gel 60 F 254 (layer thickness 0.25 mm) for alcoholic extract of HK in benzene: ethyl acetate (3:1) as mobile phase. For spot detection iodine vapour was used. The R_f values of the spots were calculated by the following formula (Jenkins *et al*., 2008).

$$R_f \text{ value} = \frac{Distance\ travelled\ by\ the\ spot}{Distance\ travelled\ by\ the\ solvent}$$

Table 1: Organoleptic description of Habbe Kafoori

Appearance	Pill
Colour	Straw
Smell	Like Kafoor and Sandal
Texture	Hard
Taste	Bitter and acrid

Table 2: Weight variation of Habbe Kafoori

Sl. No	**Weight of individual Habb (mg)**	**Difference in weight from mean(mg)**	**Weight variation** (%)
1.	507	2.15	0.43
2.	493	11.85	2.35
3.	505	0.15	0.03
4.	512	7.15	1.42
5.	499	5.85	1.16
6.	517	12.15	2.40
7.	489	15.85	3.14
8.	502	2.85	0.56
9.	516	11.15	2.21
10.	497	7.85	1.55
11.	506	1.15	0.23
12.	512	7.15	1.42
13.	508	3.15	0.62
14.	493	11.85	2.35
15.	510	5.15	1.02

Sl. No	Weight of individual Habb (mg)	Difference in weight from mean(mg)	Weight variation (%)
16.	513	8.15	1.61
17.	505	0.15	0.03
18.	499	5.85	1.16
19.	513	8.15	1.61
20.	501	3.85	0.76
Mean ± SEM	504.85 ± 1.80		

Table 3: Diameter, Hardness and Friability of Habbe Kafoori

Sl. No	Diameter of Pill (mm)	Hardness (kg/cm)	Friability (%)
1.	9.8	6.4	0.07
2.	10	6.7	0.10
3.	10.1	6.6	0.10
Mean ± SEM	9.97 ± 0.09	6.57 ± 0.09	0.09 ± 0.01

Table 4: pH Values, Moisture content and Loss of Weight on drying of Habbe Kafoori

Sl. No	pH Values		Moisture Content (%)	Loss of weight on drying (%)
	1% Solution	10% Solution		
1.	6.03	5.80	5	7.95
2.	6.02	5.78	6	7.84
3.	6.04	5.82	6	9.23
Mean ± SEM	6.03 ± 0.01	5.8 ± 0.01	5.67 ± 0.33	8.34 ± 0.45

Table 5: Ash Values of Habbe Kafoori

Sl. No	Total ash (%)	Acid insoluble ash (%)	Water soluble ash (%)
1.	18.08	15.11	3.29
2.	18.06	15.22	1.25
3.	17.99	15.06	1.49
Mean ± SEM	18.04 ± 0.03	15.13 ± 0.05	2.01 ± 0.64

Table 6: Alcohol and Water soluble matter of Habbe Kafoori

Sl. No	Alcohol soluble matter (%)	Water soluble matter (%)
1.	5.98	3.03
2.	5.75	2.78
3.	5.53	3.30
Mean ± SEM	5.75 ± 0.13	3.03 ± 0.15

Table 7: Non-successive and successive extractive values of Habbe Kafoori

Sl. No	Non-Successive Extractive Values		Successive Extractive Values		
	Water (%)	Alcohol (%)	Petroleum ether (%)	Alcohol (%)	Water (%)
1.	3.89	10.23	7.03	2.69	2.45
2.	4.72	9.52	7.05	2.72	2.48
3.	5.83	8.98	7.10	2.66	2.72
Mean ± SEM	4.81 ± 0.56	9.58 ± 0.36	7.06 ± 0.02	2.69 ± 0.02	2.55 ± 0.08

Table 8: Total Alkaloidal Estimation of Habbe Kafoori

Sl. No	Total Alkaloidal Content (%)
1.	0.34
2.	0.3
3.	0.28
Mean ± SEM	0.307 ± 0.02

Table 9: TLC of Habbe Kafoori

Extract	Solvent	Treatment	No. of Spots	Rf Value	Colour
Ethanol	Benzene:Ethyl acetate (3:1)	Iodine Vapour	4	0.14, 0.705, 0.769, and 0.846	Yellow

Figure 1: Sample of Habbe Kafoori

Figure 2: TLC of Habbe Kafoori

Results and Discussion

Physico-chemical studies

The organoleptic characteristics i.e. appearance, colour, smell and taste of HK were found to be round in shape, straw coloured, having Kafoor and Sandal like smell and bitter and acrid in taste (Table 1) (Figure 1).

Weight variation of pill: The mean value of randomly selected 20 pills was found to be 504.85±1.80 mg. This test was done to help ensure that a pill contains the proper amount of drug. All 20 pills when weighed individually were found to be within the permissible limit of 5 % (Table 2).

Diameter: Diameter was measured to ensure the uniformity in size of the pills and the amount of drug. The mean value of the diameter was found to be 9.97 ± 0.09 mm (Table 3).

Hardness: The mean value of the hardness was found to be 6.57 ± 0.09 kg/cm, this test was done to determine the force needed to fracture or break the formulation (Table 3).

Friability: The mean percentage of friability was found to be 0.09 ± 0.01. Test was done to find out any possible reduction in the weight of the solid dosage forms as a result of mechanical erosion during handling, packaging and transportation due to removal of the small fragments and particles from the surface of the solid dosage forms (Table 3).

pH Values: pH value of the drug was determined in 1% and 10% aqueous solution and the values were found to be 6.03 ± 0.01 and 5.8 ± 0.01, respectively (Table 4).

Moisture content: It is a good parameter for detecting the quality of the drugs. Variation in moisture level affects the quality of the drug and also its efficacy. The mean percentage of the moisture content was found to be 5.67 ± 0.33 (Table 4).

Loss of weight on drying: It is undertaken to determine the amount of water or volatile matter in the sample, which is removed during drying process. The mean percentage of loss of weight on drying was found to be 8.34 ± 0.45 (Table 4).

Ash value of the drug was determined for detecting inorganic matter of the drug. An ash determination is a basis of judging the identity of the drug and gives information related to its adulteration with inorganic matter. The mean percentage values of the total ash, acid insoluble ash and water soluble ash were found to be 18.04 ± 0.03, 15.13 ± 0.05 and 2.01 ± 0.64, respectively (Table 5).

Alcohol and water soluble matter: Amount of drug soluble in a given solvent is an index of its purity. The mean percentage of alcohol and water soluble content was found to be 5.75 ± 0.13 and 3.03 ± 0.15, respectively (Table 6).

Extractive value is an index of the purity of the drugs and helps in the determination of adulteration and variation if any, in the chemical constituents because it leads to the change in the extractive values. The mean percentage of the non-successive extractive values in water and alcohol were found to be 4.81 ± 0.56 and 9.58 ± 0.36, respectively. The mean percentage of the successive extractive values with petroleum ether, alcohol and water were found to be 7.06 ± 0.02, 2.69 ± 0.02 and 2.55 ± 0.08, respectively (Table 7).

Alkaloids are characterized by their high potency and efficacy. Little variation in alkaloid may cause a major change in the efficacy of drug. The mean value of total alkaloidal estimation of HK was found to be 0.307 ± 0.02 % (Table 8).

Thin layer chromatography: It is one of the important parameters used for judging the quality of the drugs and for detecting the adulteration. Four spots were found on TLC silica plate with the alcoholic extract of HK. The Rf values were found to be 0.14, 0.705, 0.769, and 0.846 (Table 9, Figure 2).

The findings of the study sets the physicochemical standards of HK which may be used for future reference and may be used to compare the test drugs intended to be used in the management of diseases. Since the biological activity of plant drugs and their preparations depends mainly on the authenticity of the ingredients and the procedure used for their processing and final preparation therefore physicochemical parameters are considered important to ensure the quality and thereby efficacy of a drug. Since HK is a commonly used drug and is prepared by many pharmaceutical companies therefore the findings of present study will help the practitioners and pharmaceutical industries alike.

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Useful Folk Mediicnal Plants and Their Diversity Status in Southern Western Ghats of Tamil Nadu, Karnataka and Kerala

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Abstract

Ethno-botanical leads are invaluable for the discovery of novel active compounds from natural sources. An ethno-botanical survey has been carried out in the tribal dominated areas of Tamil Nadu, Karnataka and Kerala to document the uses and status of the folk medicinal plants among the tribal communities of Western Ghats region of Southern India. The information on folk medicinal plants used by the tribal communities and local inhabitants for various ailments are gathered from the tribal people and inhabitant of Coimbatore, Triunelveli and Kanniyakumari districts in Tamil Nadu, Wayanad forest divisions in Wayanad district, Kerala and Chamarajanagar wildlife division, Chamarajanagar district, Karnataka State. The study mainly focused on the wild plants used by the tribal and local people to cure various health care ailments. It is also revealed that the analysis of floristic diversity of 148 folk medicinal plants species belonging to 120 genus which includes 53 families. Traditional knowledge of medicinal plants and indigenous use of plant material have provided the basis for many pharmaceuticals used today and there are still many potential pharmaceutical compounds yet to be discovered. In this context further extensive field studies may help in the discovery of new plant species used in the indigenous systems of medicine for the betterment of health care needs. Present work is based on this rationale and provides first-hand information on folk medicinal claims of the area investigated.

Keywords: Ethno-medicine, Tribal, Traditional Knowledge, Western Ghats

Introduction

Ethno-botanical leads are invaluable for the discovery of novel active compounds from natural source, particularly from plants, since new diseases as well as drug resistant strains of known pathogens continue to emerge the search for novel compounds. Traditional knowledge of medicinal plants and indigenous use of plant material have provided the basis for many pharmaceuticals used today and there are still many potential pharmaceutical compounds yet to be discovered (Asolkar *et al*., 1992). There is a risk, however, of losing this precious resource and many indigenous cultures as well as the medicinal plants themselves are threatened with extinction. Based on this rationale the present study was undertaken and provides data on ethno-pharmacological field studies and literature survey conducted in rural and suburban places, at the study areas of Tamil Nadu, Karnataka and Kerala during 2005-2010 to contribute material for further investigations in the search of new drugs of plants origin (Anonymous, 1994).

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The tribal populations inhabit varied geographical and climatic zones of the country. Living close to nature, the tribal's have acquired unique knowledge about the indigenous flora and fauna and their uses. Most of which are not known to the outside world. Therefore, ethno-botanical studies assume great importance in enhancing the knowledge about the plants grown and used by native/tribal communities, the rich diversity assembled by them for their sustenance and different means adopted by them for its preservation/conservation.

Some important contributions in this direction are those of Apparanantham and chelladurai, (1994,1986); Augustine Joy (2005); Hema (2007); Jain, (1981,1991); Jain *et al*.,1973, 1991; Mini (2007); Murgeswaran *et al*., 2010, 2011, 2013, 2014, 2015); Narayanan (2011); Nisha (2007); Pramod and Sivadasan (2003), Subramaniam, (1999), Rosakutty*et al*., (1999), Ravikumar*et al*., (2004), Udayan *et al*., (2008) and Yoganarasimban *et al*., (1991; 1982).

The present work embodies the data on folk medicinal plants and their uses collected during 2005-2010 on folklore medicines through extensive field studies and interviews with tribal and rural inhabitants in the study areas of states of Tamil Nadu, Karnataka and Kerala.

The study areas

The study areas covered included Coimbatore, Triunelveli and Kanniyakumari districts in Tamil Nadu, Wayanad district in Kerala and, Chamarajanagar district in Karnataka State. The studies were carried out in forest areas, tribal colonies and settlements of the above districts. The study area falls under the hill tract of Southern western Ghats of Tamil Nadu, Karnataka and Kerala. The different ethnic groups of tribal communities like Paliyar, Irular Kani, Soligar, Malayali and Kattunayakan. Apart from these tribal communities the local non-tribal communities of the study areas were also interviewed who possess good knowledge of folk medicine. All these resources have been recorded by the researchers as first-hand field data on folk medicinal plants from the study area(s).

Methodology

The information on folk drug plants were obtained in the course of a series of ethnopharmacological surveys of the study area conducted during 2005 to 2010. The information presented is essentially based on the first-hand data collected through interviewing herbal medicine men of the study area during the course of the ethnoparmacological field investigations. The study has brought to light some interesting traditional therapeutic methods applied by the native of different forest area of Tamil Nadu, Karnataka and Kerala states. 149 taxa of medical plants were collected and indentified with the help of some floras from the study area. Voucher herbarium specimens prepared and deposited in the herbarium of the Survey of Medicinal Plants Unit, RRIUM, Chennai. In most of the cases

the botanical specimens were identified and confirmed at Botanical Survey of India Coimbatore.

During survey, the informant had to be convinced that their co-operation was of great benefit to the country. The survey team therefore, visited the healers in their respective localities and they were of great help to discuss and reveal folk medicinal uses of local plants and to show their samples either in the field or in the camp. For each plant, the following information was gathered; (i) common name of the plant, or crude drug; (ii) medicinal use(s); (iii) part(s) used; (iv) other ingredients added (if any); (v) method of drug preparations; (vi) mode of application; (vii) dosage and duration of treatment, and; (viii) precautions (if any).

Plant specimens were collected and entered in the field book each day. For botanical identification, the flora of British India (Hooker, 1872-1897), Flora of Tamil Nadu Carnatic (Matthew, 1983), The flora of Tamil Nadu (Nair and Henry., 1982), (Hentry*et al*., (1987, 1989) Flora of the Presidency of Madras (Gamble, 1936). Additions to this flora of Karnataka. (Ravikumar *et al*., 2001) and Flora of Karnataka (Shaldanha, 1984). The literature survey for general information and biodynamic notes and therapeutic uses for identified plants was carried out. The main information sources were; the wealth of India 'Raw materials'. (Hussain *et al*., 1992). Medicinal plants of India. (Anonymous, 1976, 1987). Notable Plants in Ethnomedicine of India (Jain *et al*., 1991). 'Compendium of Indian Medicinal plants' (Rastogi and Mehrota, 1990-1998); Second supplementary to Glossary of Indian Medicinal Plants with Active principles' (Asolkar *et al*., 1992); Glossary of Indian Medicinal Plants' (Chopra *et al*., 1956).

Results

Table 1: Folk Medicinal Plants of Southern Western Ghats, India

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Abrus precatorius L. RRIUM-CH: 8511, 8929	Kundumani (T)	Leaf	Swellings	Climber	C
Abutilon indicum (L) Sweet. RRIUM-CH: 9365	Tuthi (T) Baralukaddi (K)	Leaf	Piles, Wounds Leaf Juice Cough	Herb	C
Acacia leucophloea (Roxb.) Willd RRIUM-CH: 9503	Velvelam (T) Nayibela (K)	Gum	Health tonic	Tree	C
Acacia nilotica (L) Willd ex Del RRIUM-CH: 9412	Karuvelam (T) Karijaali (K)	Bark Fruit	Diarrhoea, dysentery Sexual disorders	Tree	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Acacia sinuata (Lour) Merr. RRIUM-CH: 9412, 9678	Shikaka (M) Cige (K)	Fruit	Expectorant, dandruff	Climber	C
Ach Acyranthes aspera L. RRIUM-CH: 8824,8979, 9283, 9647	Nayuruvi (T) Uttareni (K)	Leaf Stem	Dental care and Strengthen-ing gums	Herb	C
Adiantum capillus-veneris L. RRIUM-CH: 9897	Mangayar kunthalparani (M)	Leaf	bone fracture	Herb	C
Aegle marmelos (L.) Corr. RRIUM-CH: 9233, 9499	Vilvam (T) Belapatre (K)	Fruit	Asthma, laxative	Tree	S
Aerva lanata (L) Juss. ex Schult. RRIUM-CH: 9427	Poolanpundu (T) Bile sole gida (K)	Root leaf whole plant	scorpion stinging, headache Kidney stone, urinary irritations	Herb	C
Ageratum conyzoides L. RRIUM-CH: 8446	Mookuthipul (T) Helukasa (K)	Leaf	Cut injuries	Herb	C
Alangium salvifolium (L.f) Wangerin.	Alingil (T)	Fruit Bark	Refrigerant Hypotensive	Tree	S
Albizi aamara (Roxb.) Boivin. RRIUM-CH: 8351, 9477	Usil (T) Chalavagai (K)	Leaf, Seed	Hair falling, Piles	Tree	C
Albiza lebbeck (L) Benth RRIUM-CH: 9302	Vagai (T) Baage (K)	Bark, Seed	Skin irritation, Skin diseases	Tree	C
Allium cepa L. RRIUM-CH: 9432	Vengayam (T) Eetilli (Kannada)	Extraction Leaf	Asthma, Diabetic	Herb	C/C
Alpinia galanga Sw RRIUM-CH: 9539	Perarattai (T) Dhumarasmi (K)	Rhizome	Fever	Herb	C/C
Alstonia scholaris (L) R.Br. RRIUM-CH: 8371	Eazhilaipalai (T) Aelele hale (K)	Bark	Diarrhoea Headache	Tree	S
Alternanthera sessilis (L) R. Br. ex DC. RRIUM-CH: 8938	Ponnankani (T)	Leaf Leaf	Stomach pain Stomach ulcers	Herb	C
Amaranthus spinosus L RRIUM-CH: 8572, 8941, 9170, 9898	Chaulai, muludantu (K)	Leaf Root	Boils, Swellings Eczema Laxative	Herb	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Amaranthus viridis L RRIUM-CH: 9418	Mullukeerai (T) Chelakeeraesoppu (K)	Leaf	Poisonous bites	Herb	C
Anacardium occidentale L. RRIUM-CH: 9012, 9668	Mundiri (T) Kapamava (M)	Seed Resinous juice	Foot crake Palpitation	Tree	C/C
Andrographis paniculata (Burm. f.) Wall. ex Nees. RRIUM-CH: 8690, 8931	Nilavembu (T)	Leaf	Stomach pain Itching, Fever	Herb	R
Anogeissus latifolia (Roxb. ex DC.) Wall. ex Guill. & Perr. RRIUM-CH: 9131	Vellai-Nagai (T) Dindal (K)	Stem Bark Leaf	Snake bite	Tree	C
Argemonem exiana L. RRIUM-CH: 9178	Bramathandu (T) Arasinaomathai (K)	Seed	Psoriasis	Herb	C
Aristolochia indica L RRIUM-CH: 8689	Perumarunthu (T)	Leaf	Eczema	Climber	R
Asclepia scurassavica L RRIUM-CH: 8673, 8952	Neeraruvi (K)	Root	Piles, Scabies Cut injuries	Herb	C
Asparagus racemosus Willd. RRIUM-CH: 9263, 9826	Amukrakilangu (T) Aashaadibaeru (K)	root	Stomach pain due to irregular menstruation White discharges	Climber	R
Azadirachta indica A Juss. RRIUM-CH:9232	Vemmbu, Balanthibaeru (K)	Stem Bark Seed	Fever, Diabetic wounds	Tree	C
Bauhinia purpurea L. RRIUM-CH: 9526	Mandarai (T) Akilu (K)	Bark Leaf	Malarial fever	Herb	C
Boerhavia diffusa L. RRIUM-CH:9383	Mookeratai (T) Adakaputhanagida (K)	Root	Jaundice, Leaf wounds	Herb	C
Bixa orellana L. RRIUM-CH: 8659	Kurangumanjal	Seeds bulb seed	Headache Dysentery		C
Butea monosperma (Lam) Taub RRIUM-CH: 8686, 9440	Kattuthee	Seed Flowers	Ring worm Swellings	Tree	C
Caesalpinia crista L. RRIUM-CH:9357	Kalatchikai (T) Gajaga (K)	Leaf Seed	Hydrocele Fever	Climber	S

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Calophyllum inophyllum L. RRIUM-CH: 8670	Pinnai (T)	Seed	Joint pain	Tree	S
Calotropis gigantea (L.) R. Br. RRIUM-CH: 8592, 8963, 8883, 9114	Erukku, Aarka (K)	Latex	Insect bite	Herb	C
Cardiospermum canescens Wall. RRIUM-CH: 9486, 8444, 8878, 9735	Mudakuthan (T) Agniballa (K)	Leaf leaves	Stomach pain Joint pain	Climber	C
Cardiospermum helicacabum L. RRIUM-CH: 8444, 8878, 9169	Mudakathan (T) Battekaayiballi (K)	Seeds Leaves	Joint pain Laxative	Climber	C
Cariss Carissa carandas L RRIUM-CH: 8348	Kalakai (T)	Fruit	General health Indigestion	Tree	C
Cassia alata L. RRIUM-CH: 8843, 8930	Seemaiagathi, Kaddumardu	Leaf Stem	Skin diseases Ring warm Toothache	Shrub	C
Cassia auriculata L. RRIUM-CH: 8565, 8763, 9390	Aavarai (T) Aavarika (K)	Flowers leaf	Dandruff diabetes	Shrub	C
Cassia fistula L. RRIUM-CH: 8385, 8454, 8769, 8923, 9109, 9813,	Kondrai (T), Araghvada (K)	Flowers Fruit Bark fruit powder	Stomach pain Asthma, Knee swelling Muscular pain	Tree	C
Cassia occidentalis L RRIUM-CH: 8746, 8988, 9308	Thakarai (T) Aanesogata (K)	Leaf Seed	Psoriasis Cough	Herb	C
Cassia tora L. RRIUM-CH: 8951, 9360, 9435	Tantemu Cagace (K)	Leaf Seed	Ringworm Jaundice	Herb	C
Catharanthus roseus (L) G. Don RRIUM-CH: 9210, 9612	Nithyakalyani batelahoo (K)	Leaf Fruit	Diabetes Leach bite	Herb	C
Catunaregam spinosa (Thunb.) Tirveng RRIUM-CH: 8355, 8810, 8879	Madukarai (T)	Fruit	Rheumatism Worm infestation	Tree	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Centella asiatica (L) Urban RRIUM-CH: 9679	Vallarai Brahmeesoppu (K)	Leaf	Laxative Leprosy	Herb	C
Cinnamomum wightii Meisner. RRIUM-CH: 8778	Kattukaruva (T)	Bark	Cold	Tree	V
Cinnamomum verum Presl. RRIUM-CH: 8933	Lavangampattai (T)	Bark Leaf	Vomiting Stomach pain	Tree	V
Cissus quadrangularis L. RRIUM-CH: 9429	Pirandai (T) Asthisamboora (K)	Stem Leaf	Stomach pain Indigestion	Climber	C
Citrullus colocynthis (L) Schrader. RRIUM-CH: 8377, 8705	Aathuthumatti (T)	Fruit	Dark spot Stomach pain	Climber	C
Citrus limon (L) Burm. f. RRIUM-CH: 9465, 8705	Elumichai (T) Brihatnimbu (K)	Fruit	Stomach pain Scabies	Tree	C
Clerodendrum inerme (L) Gaertn. RRIUM-CH: 8916	Pekallathi (or) Peenarisangu (T)	Leaf Fruit	Itching Scabies	Tree	C
Clitoria ternatea L. RRIUM-CH: 8927, 9231	Sangupushpam (T) Girikannike (K)	Whole plant Seed leaf	Snake bite Wounds, Eye diseases of cattle	Climber	C
Coccinia grandis (L)Voigt. RRIUM-CH: 9217	Kovai, Kaagethonde (K)	Root Root fruit	Rheumatism Joint pain Diabetes	Climber	C
Coffea arabica L. RRIUM-CH: 9471	Kappi, Bannugida (K)	Seed	Stimulant	Shrub	C/C
Costus speciosus (J Koenig.) Smith RRIUM-CH:11224	Insulinkerrai (T) Anakkuva (M)	Leaf	Swelling Irregular menstruation	Herb	C
Crotalaria retusa L. RRIUM-CH : 9486	Kilukillupai (T) Gijat (K)	Leaf	Scabies	Herb	C
Croton bonplandianus Baillon RRIUM-CH: 8984, 9174	Amanakupoondu (T) Somari (K)	Latex	Wounds	Herb	C
Cryptolepis buchanani Roem. & Schult. RRIUM-CH: 9313	Keeripalai (T) Karanda (K)	Stem Root bark	Malarial fever Rheumatism	Climber	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Curculigo orchioides Gaertner RRIUM-CH: 9253	Nelatatygadda Nelalengu (K)	Rhizome	Asthma Sexual disorders	Herb	S
Cuscuta reflexa Roxb. RRIUM-CH: 8973, 9177, 9790	Ootuchedi Amaraballi (K) Akasavalli (M)	Whole plant	Boils Constipation Jaundice	Herb	C
Cymbopogon citrates (DC.) Stapf RRIUM-CH:9890	Thailapull (T) Chaahullu (M)	Leaf	Body pain Headache	Herb	C
Derris canarensis (Dalz) Baker RRIUM-CH: 8956	Vangaivalli (T)	Leaf	joint pain	W. Climber	R
Dioscorea bulbifera L. RRIUM-CH: 9816	Kattukaccil (M)	Tuber	Energy food Ulcers	Climber	C
Eclipta prostrata (L.) L. RRIUM-CH: 8722, 9394	Karisalangani (T) Ajaagara (K)	Leaf whole plant	Dandruff, hair falling Cuts injuries ulcers	Herb	C
Elaeocarpus tuberculatus Roxb. RRIUM-CH:9458	Malampinnai (M) Ruthraksham (T)	Seeds	Rheumatic pain	Tree	C
Erythrina varigata L RRIUM-CH: 9575	Kalyanamurungai (T), Bilivaarjipae (K)	Bark Seed	Leprosy Jaundice	Tree	C
Eucalyptus globules Labill. RRIUM-CH:9419	Thailamaram (T) Karpurathailaviricha (K)	Leaf Leaf	Body pain Headache	Tree	C
Euphorbia cyathophora Murray.RRIUM-CH: 8889	Palperukki	Latex Leaf	Headache Wounds	Herb	C
Euphoribia hirta L. RRIUM-CH: 8947, 9387, 9900	Amman pacharasi (T), Acchacchegida (K), Nilappal (M)	whole plant leaf	Worm infestation Asthma Diarrhoea	Herb	C
Ficus benghalensis L. RRIUM-CH: 9531	Aaladamara (K)	Latex Bark	Bleeding gum Dysentery	Tree	C
Ficus hispida L. f RRIUM CH: 8961	Peiathi (T)	Fruit Leaf	Gonorrhoea Stomach pain	Tree	C
Ficus racemosa L. RRIUM-CH:9573	Atthi (T)	Leaf Bark	Dysentery Leucorrhoea	Tree	C
Ficus religiosa L. RRIUM-CH: 8718	Acakam (K)	Bark Leaf	Scabies Diabetic	Tree	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Garcinia gummi-gutta (L) Robs. RRIUM-CH: 8872	Kodukaipalli	Seeds Fruit	Eczema, Bone fracture	Tree	S
Gloriosa superba L RRIUM-CH: 8622, 9001	Senkandal (T) KalapaiKizhangu (T)	Seed whole plant	Leprosy (expect tuber) Uterine fibbers	Herb	R
Gmelina arborea Roxb. RRIUM-CH: 9346	Kumiltekku (T) Kumula (M) Baachanikemara (K)	Stem Bark Leaf	Laxative, Ulcer	Tree	C
Gossypium hirsutum L. RRIUM-CH:9439	Paruthi (T) Americanehatthi (K)	Seed	Health tonic Expectorant	Herb	C
Gynandropsis pentaphylla DC. RRIUM-CH: 9310	Naivelai(T) Shrikala (K)	Leaf	Scabies Joint pain	Herb	C
Helianthus annus L. RRIUM-CH: 9397	Suriyakanthi (T) Adityabhakti (K)	Seed Leaf	Cold and cough, Scabies	Herb	C
Helicteres isora L RRIUM-CH: 8749, 8884	Edampuri Valampuri (T)	Fruit Leaf Bark	Dandruff Ring worm Dry cough	Tree	C
Hemidesmus indicus (L) R. Br. RRIUM-CH: 9033	Nannari (T)	Root	Fever	Herb	C
Hibicus rosa-sinensis L. RRIUM-CH: 8917	Sembarathi (T)	Leaf Flower	Boils, Expulsion of placenta Menstrual disorders	Herb	C
Hybanthus enneaspermus (L) F Muell. RRIUM-CH: 8968	Orilaithamari (T)	Leaf whole plant	Dysentery Jaundice	Herb	S
Hygrophila auriculata (Schum.) Heine. RRIUM-CH: 8991, 9220, 9797	Neerumulli (T) Kolavalike (K) Vayalculli (M)	Leaf Root	Jaundice Uterine tonic	Herb	S
Ichnocarpus frutescens (L) R.Br. RRIUM-CH: 8716	Udharkodi (T)	Latex Root	Headache Fever	Herb	S
Indigofera tinctoria L RRIUM-CH:8825	Averi (T)	Root Leaf	Abdominal pain, Hair tonic	Herb	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Ipomoea nil (L) Roth. RRIUM-CH: 8828	Kakatan (T)	Root Seed	Purgative Ringworm	Climber	C
Jasminum malabaricum Wight. RRIUM-CH: 8788, 8911	Kuruvilangkodi (M)	Leaf Flower	Scabies, Headache Brest pain	Climber	C
Justicia adhatoda L. RRIUM-CH: 9703	Aduthoda (T) Adalodagam (K)	Leaf Leaf	Cough and cold, Joint pain	Herb	C/C
Lantana camara L. RRIUM-CH: 8449, 8831	Unnichedi (T)	Leaf Fruit	Antiseptic Wound healing	Herb	C
Leucas aspera (Willd.) Link. RRIUM-CH: 8992, 9293	KasiThumbai (T)	Leaf	Jaundice Psoriasis	Herb	C
Leucas indica (L.) R. Br. ex Vatke RRIUM-CH: 9828	Mosappullu (T)	Leaf	Wounds Jaundice	Herb	C
Leucas martinicensis (Jacq.) R. Br. RRIUM-CH: 8637	Thumbai (T)	Root Leaf	Psoriasis, Skin rashes	Herb	C
Limonia acidissima L. RRIUM-CH: 8564	Vilam (T)	Gums Leaf	Dysentery Gastric troubles	Tree	S
Lobelia nicotianefolia Roth. ex Scheltes RRIUM-CH: 8851, 9464	Kattuphuyulai (T) Doddakaadu (K)	Leaf	Asthma, Scabies	Herb	C
Mallotus philippensis (Lam.) Muell Arg. RRIUM-CH: 8441	Kamala (T) Kapli (K)	Bark Seed	General tonic, Eczema	Tree	C
Melia azedarach L. RRIUM-CH: 9336	Arabaevu (K)	Seed Bark Heart wood	Malarial fever Asthma	Tree	C
Mimosa pudica L. RRIUM-CH: 9125, 9673	Thotalvadi (T)	Root Leaf	Jaundice, Hydrocele	Herb	C
Mirabilis jalapa L. RRIUM-CH: 9281	Anthimalligai (T) Chandramallige (K)	Leaf Leaf	Jaundice Itching	Herb	C
Morinda tinctoria Roxb. RRIUM-CH: 9130	Nuna (T) Maddiainshi (K)	Leaf	Wounds Stomach ulcer Asthma	Tree	C
Mucuna pruriens (L) DC. RRIUM-CH: 9462, 9773	Punaikkali (T) Chinakeebeeja (K)		sexual disorders	Climber	R

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Nerium oleander L. RRIUM-CH: 9504	Arali (T) Ashvamaaraka (K)	Root Leaf	Scabies Swelling	Tree	C
Ocimum basilicum L. RRIUM-CH: 8715, 8903, 8975	Jangali tulsi (T) Aamalaka (K)	Leaf	Stomach pain, ringworm	Herb	C
Ocimum gratissimum L. RRIUM-CH: 8634, 8932	Gaya Tulsi (T)	Leaf Seed Leaf	Asthma, cold ringworm Joint pain	Herb	C
Pedalium murex L. RRIUM-CH: 10700	Yanai Nerungi (T)	Leaf Flower	Stomach pain Headache Menstrual disorders	Herb	C
Phyllanthus amarus Schum. &Thonn.	Keelanelli (T)	Plant	Body heat Urinary infection Jaundice	Herb	C
Phyllanthus emblica L. RRIUM-CH: 9268	Nelli (T) Aamalakee (K)	Leaf	Wounds Jaundice Cough, cold	Tree	C
Phyllanthus reticulatus Poir. RRIUM-CH: 8963	KattuKeelanelli (T)	Leaf	Toothache Bleeding gums	Herb	C
Physalis minima L. RRIUM-CH: 8514, 8976	Siruthakali (T) Makabari (K)	Leaf Fruit	Cold, Cough Abdominal pain	Herb	C
Pergularia daemia (Forsk.) Chiov. RRIUM-CH: 8671	Seenthilkodi (T)	Root Leaf	Headache Foetidal discharge	Climber	C
Phoenix sylvestris (L) Roxb. RRIUM-CH: 9331	Eacham (T) Andaeechalu (K)	Fruit	Gastric troubles	Shrub	C
Piper longum L. RRIUM-CH: 8966, 9742	Kattuthipili (T) Capala (M)	Fruit	Cough	Herb	C
Piper nigrum L. RRIUM-CH: 8876	Kurumilagu (T)	Seed	Fever Body pain	Climber	C
Plectranthus amboinicus (Lour.) Spreng. RRIUM-CH: 8635	Karpuravalli (T)	Leaf	Cold	Herb	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Plumbago zeylanica L. RRIUM-CH: 8977, 9239, 8801	Chitarimoolam (T) Agnipaavaka (K)	Leaf Root	Menstrual disorders Itching, Headache	Herb	C
Polygonum chinense L. RRIUM-CH: 8747	Nelakumbala (T)	Leaf	Skin diseases	Herb	C
Polygonum glabrum Willd. RRIUM-CH: 8944	Sivappu Kumbakodaali (T)	Leaf	Stomach pain	Herb	C
Pterocarpus marsupium Roxb. RRIUM-CH: 8755, 9078	Vengai (T)	Latex	Headache Toothache	Tree	C
Rauvolfia serpentina (L) Benth. ex Kurz. RRIUM-CH: 8756, 8959	Sarpgandh (T) Swetbarua (K)	Leaf Root	Poisonous bite Chest pain	Herb	R
Rauvolfia tetraphylla L. RRIUM-CH: 9535, 9644	Serpagantha (M) Doddachandrike (K)	Root	Blood pressure	Shrub	C
Ricinus communis L. RRIUM-CH: 9018, 9341, 9696	Amanaku (T) Aalambuda (K) Amandam (M)	Leaf	Laxative Stomach pain Boils	Tree	C
Rubia cordifolia L. RRIUM-CH: 8447, 8751	Manjiti (T) Kavilaikodi (M)	Root Flower	Headache	Climber	C
Ruta chalepensis L. RRIUM-CH: 9538, 9747	Aruvada (T) Sadabu (K) Aruta (M)	Leaf	Rheumatic Headache	Herb	C
Semecarpus anacardium L. f. RRIUM-CH: 9559	Serangottai (T) Gheru, Agnimukhi (K)	Gum	Nervine tonic	Tree	S
Sida acuta Burm. f. RRIUM-CH: 9832	Bajramuli (K) Cerparuva (M)	Leaf Twigs Root	Boils tooth ache Bone fracture	Herb	C
Solanum anguivi Lam. RRIUM-CH: 8950	Mulu Sundai (T)	Fruit	Toothache	Herb	C
Solanum nigrum L. RRIUM-CH: No: 8632	Giwain (K)	Leaf	Ulcer	Herb	C/C
Solanum pubescens L. RRIUM-CH: 8647	Akranti (T)	Root	stomach pain	Herb	C
Solanum surattense L. RRIUM-CH: 8326, 8731, 8805, 8790	Kandamkathiri (T)	Fruit	Toothache dental care Asthma	Herb	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Solanum torvum Sw. RRIUM-CH: 9996	Sundai (T)	Seed Fruit	Toothache Stomach pain	Herb	C
Stachytarpheta indica (L) Vahl. RRIUM-CH: 8962	Semainayuruvi (T)	Leaf	Fever	Herb	C
Strychnos nux-vomica L. RRIUM-CH: 8354	Eatti (T)	Leaf	Rheumatic pain	Tree	S
Syzygium cumini (L)Skeels. RRIUM-CH: 8336, 8566	Naval (T)	Fruit Leaf	Diarrhoea Muscular pain	Tree	C
Tabernaemontana divaricata (L.) R. Br. ex Roem. RRIUM-CH: 8873, 9242	Nanthiyavatai (T) Kokkekaayigida (K)	Latex	Wounds	Herb	C
Tephrosia purpurea (L) Pers. RRIUM-CH: 8920	Venipali (K)	Seed	Scabies, Itching	Herb	C
Terminalia arjuna (Roxb. ex DC.) RRIUM-CH: 9599, 9834	Maruthu (K) Arjunamara (M)	Bark	chest pain, Skin diseases	Tree	C
Terminalia bellerica (Gaertn.) Roxb. RRIUM-CH: 8349, 9498	Thani (T), Bedaro (K)	Seed	Diarrhoea Asthma	Tree	C
Terminalia catappa L. RRIUM-CH: 8924	Badam (T)	Latex	Swellings	Tree	C
Terminalia chebula Retz. RRIUM-CH: 7715, 7334	Kadukai (T)	Fruit	Tooth ache General health	Tree	S
Terminalia paniculata Roth. RRIUM-CH: 9135	Karumaruthu (T) Karimati (K)	Flower Bark	Fever, Carminative	Tree	C
Thottea siliqusa (Lam.) Ding. RRIUM-CH: 9602	Alpam (M)	Leaf Root	Injury, Fever	Herb	C
Tinospora cordifolia (Willd.) Miers. ex Hook. f. & Thoms. RRIUM-CH: 8602, 9426	Seenthil (T) Aganiballi (K)	Leaf	Fever Dysentery	Climber	C
Trichopus zeylanicus Gaertn. RRIUM-CH: 8954	Arokiyapachi (T)	Fruit	General health	Herb	S
Tridax procumbens L. RRIUM-CH: 8972	Aruvamookupoondu (T)	Leaf	Injuries	Herb	C
Vitex negundo L. RRIUM-CH: 9091	Notchi (T)	Leaf	Migraine Asthma Headache	Tree	C

Botanical Name	Local Name	Part Used	Curative diseases	Habit	Status
Wedelia chinensis (Osbeck.) Merr. RRIUM-CH: 8937	Manjalkarisalankani (T)	Leaf	Cough, Asthma	Herb	C
Wrightia tinctoria Roxb.) R. Br. RRIUM-CH: 8576, 8761, 8880	Veppalai (T)	Leaf Latex Fruit	Toothache Headache General health	Tree	C
Ziziphus rugosa Lam. RRIUM-CH: 8908	Kattuillanthai (T)	Fruit	Indigestion	Tree	C

C-Common, C/C-Common & Cultivation, S-Sporadic, R-Rare, V-Vulnerable
T-Tamil, M-Malayalam, K-Kanada

Discussion

The present study revealed the floristic diversity of the folk medicinal plants and records some 148 potential medicinal plant species (Table-1) belonging to 120 number of genus which includes 53 families. The life form analysis of the present study are 58 species of herbs, 23 species of shrubs, 21 species of climbers, twiners and 46 species of trees are collected and documented. During the study about 237 useful folk medicinal preparations were collected which are used in the treatment of 86 different ailments by the traditional healers of various tribal communities in the study area. The usual methods of applications are as decoction, paste, powder, juice pill etc. These are administered internally or applied externally. Most of the recipes include only one plant species however, in some preparations combination of several herbs are also included. Moreover, some plant species are used for more than one disease and in some of the treatment single diseases may be treated by many plant species. It is, therefore, difficult to say which plant is actually effective in curing disease and the laboratory investigations and clinical trials are suggested to establish therapeutic properties of these herbal preparations for their effective and safe use.

The literature survey (Anonymous, 1948-1976; Husain *et al*., 1992; Anonymous, 1976, 1987; Jain *et al*., 1991; Rastogi and Mehrotra, 1990-1998; Kapoor, 1990; Chatterjee and Pakrashi, 1991-1994 indicates that chemical constituents and pharmacological action of most of the species are already known to some extent. However, only meager information is available on *Abutilon indicum* L. Sweet ., *Acacia sinuata* (Lour.) Merr., *Alangium salvifolium* (L.f.) Wangerin., *Alternanthera sessilis* (L.) R.Br.ex. DC. *Andrographis paniculata* (Burm.f.) Wall.ex.Nees., *Asclepias curassavica* L., *Boerhavia diffusa* L., *Bixa orellana* L., *Calophyllum inophyllum* L., *Cinnamomum wightii* Meisner., *Citrullus colocynthis* (L.) Schrader., *Costus speciosus* (J.Koenig) Smith., *Erythrina varigata* L., *Limonia acidissima*

L., *Cymbopogon citrates* (DC.) Stapf., *Garcinia cambogia* Desr., *Hemidesmus indicus* (L.) R.Br., *Ipomoea pupurea* (L.) Roth., *Leucas martinicensis* (Jacq.) R.Br., *Morinda tinctoria* Roxb., *Ocimum gratissimum* L., *Physalis minima* L., *Plumbago zeylanica* L., *Plectranthus amboinicus* (Lour.) Spreng., *Rauwolfia tetraphylla* L., *Ruta graveolens* L., *Semecarpus anacardium*L.f., *Solanum pubescens* L., *Solanum virginianum*L., *Terminalia bellerica* (Gaertn.) Roxb.,*Trichopus zeylanicus* Gaertn., *Vitex negundo* L., *Wedelia chinensis* (Osbeck.) Merr., *Zizyphus rugosa* Lamk., *Wrightia tinctoria* (Roxb.) R.Br. etc. Therefore, re-investigation of all such species is suggested for their chemical constituents and pharmacological effects.

The study also revealed that out of the 148 species recorded from the study area about 123 species fall in common category, 17 species are uncommon and about 8 species such as *Andrographis paniculata* (Burm. f.) Wall. ex Nees., *Aristolochia indica* L., *Asparagus racemosus* Willd., *Cinnamomum zeylanicum* Blume., *Derris canarensis* Baker., *Mucunapruriens* (L.) DC., *Rauvolfia serpentina* (L.) Benth. ex. Kurz. and *Semecarpus anacardium* L.f. are very much restricted in their distribution to particular localities/forest areas/region only.

In conclusion, we may say that through such investigations many more new plant drugs can be discovered from the unique folklores lying hidden among the traditional communities of other ethnopharmacologically unexplored areas of India and elsewhere, which may be utilized to the well being of human health. However, experimental and clinical evidences are needed to demonstrate the effectiveness and safety of these folk drugs before they can be accepted by the modern health care systems. Therefore, studies on toxicity, pharmacological actions, and chemical constituents are suggested for all these folk drugs in the context of reported claims.

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Ethnomedicinal Study of Some Medicinal Plants of Boudh District, Odisha

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Abstract

An ethnobotanical survey was undertaken to collect information on the use of ethnomedicinal plants in Boudh district of Odisha state in March, 2017. The exploration revealed folk use of 65 species of plants distributed in 64 genera belonging to 35 families to treat various ailments. The indigenous knowledge of local traditional healers and the native plants used for medicinal purposes were collected through questionnaire and personal interviews during the field trip. In this study the most dominant family was Euphorbiaceae and leaves were most frequently used for the treatment of diseases. Maximum species were used to cure dermatological conditions. The study enriches our existing knowledge on ethnopharmacopoea of this region of Odisha state which likely will contribute significantly to develop and discover new drugs of natural origin.

Key Words: Folk medicines, Medicinal plants, Survey, Boudh, Odisha.

Introduction

The use of plants as medicine is slowly increasing in the developed world because they have minor or no side effects (Bernal *et al*., 2011; Ekor, 2013; George, 2011; Jordan *et al*., 2010). It is estimated that 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs as they are easily available and cheaper (Mahmoud and Gairola, 2013; Shrestha and Dhillion, 2003; WHO., 2013). Modern pharmacopoeia still contains at least 25% drugs derived from plants (Rao *et al*., 2004).

Ethnobotany is not new to India because of its rich ethnic diversity. Jain (1991) pointed out that there are over 400 different tribal and other ethnic groups in India and traditional herbal medicines form an important part of their health care system. It is reported that in India traditional healers use 2500 plant species among them around 100 species of plants serve as regular sources of medicine (Pei, 2001). Documentation of Medicinal plants and their use by indigenous cultures is not only helpful for conservation of cultural traditions and biodiversity but also for community healthcare and drug development in the present and future (Ayyanar, 2012; Pei, 2001).

Odisha is endowed with quite rich plant resources in general and medicinal plants in particular. Nearly 62 different ethnic groups, inhabiting in the dense and thick tropical forest areas of Odisha state (Pattanayak *et al*., 2016). They have faith in their traditional system of health care and have their own traditional physicians who have rich and outstanding traditional knowledge and wisdom regarding plants use as their materia medica. Boudh district is one of the centrally located

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districts of Orissa. It lies between 20º22'N and 20º50'N latitudes and between 83º34'E and 84º49'E longitudes. It is bounded on the north by the districts of Sambalpur and Anugul, on the east by Anugul and Nayagarh, on the south by Nayagarh and Kandhamal and on the west by Balangir and Sonapur. Out of the Sixty-two tribal communities for the state, as many as 25 tribes are found in the district (Sahu *et al*., 2013a), where tribes such as Kondh, Gond, Saora, Kol, Binjha, Munda, etc. are predominantly inhabited in the study area. Due to less communication means, poverty, ignorance and unavailability of modern health facilities, most people especially tribal people are still forced to practice traditional medicines for their common ailments. They have their own diverse religious culture and social traditions where elders still possess good knowledge of the healing properties of local flora, acquired in the course of long experience and association with the forests.

Previously floristic and ethnobotanical study of area has been done by few workers (Behera and Nayak, 2012; Sahu, 2016; Sahu *et al*., 2013a,b&c), however, area is dominantly inhabited by various tribal and indigenous castes group which give more scope to record more and more information on traditional medicinal use of plants prevalent among the native people. Thus the aim of present exploration is to report widely used medicinal species with ethnomedicinal information with a view to contribute material to the rich herbal heritage of Odisha in an attempt to develop and discover novel plant-based pharmaceuticals.

Methodology

An ethnobotanical survey was carried out in the month of March, 2017 with a view to investigate the medicinal plants diversity and to record the folk wisdom of tribal and other rural people of the study area. The exploration was carried out in Puranakatak (Charichhak) Forest Range and Madhapur Forest Range of Harabhanga Block of Boudh Forest Division. Plant specimens were collected, pressed dried and mounted on herbarium sheets and identified on the basis of field notes, with the help of flora of Odisha (Saxena and Brahmam, 1996), Botany of Bihar & Orissa (Haines, 1921-25), other regional floras and online literature as well as through comparison with previous authenticated herbarium specimens of Survey of Medicinal Plant Unit (SMPU) of Bhadrak and deposited in the Herbarium of the SMPU of Regional Research Institute of Unani Medicine (RRIUM), Bhadrak, Odisha, for future reference. Data on folk medicinal were gathered through questionnaire and personal interviews of reliable medicine men (Vaidhya) and other knowledgeable tribal and rural people of the study area.

Folk Medicinal Plants

The plants used by the inhabitants in the study area are arranged in alphabetic order by their scientific names. Each entry provides information on correct

botanical name, family, local name, unani name (if any), locality, voucher specimen number, part used, ailment treated and folk medicinal use(s) with mode of administration and source are given in sequence (name of tribe & other native caste group). As far as possible, the probable dosage and duration of these crude drugs are also given.

Acalypha indica L. (Euphorbiaceae); Indramarish; Kuppi; Burbi RF-10898; Leaves; Cut/wounds and scabies; Leaves paste is applied on cut, wounds and scabies (Kondh/ST).

Achyranthes aspera L. (Amaranthaceae); Apamarango; Ankumah, Khare Vazanun, Chirchita; Tooth cavity, tooth infection, fever, cuts, wound & eczema; Digsira-10949; Inflorescence and fruit; Powder of inflorescence mixed with fruit powder of Gokharu (*Tribulus terrestris* L.) in equal quantity and use as tooth powder to prevent tooth cavity and tooth infection. About 10-15 ml whole plant extraction mixed with one teaspoon honey and the remedy is taken to cure fever. Extraction of whole plant is applied on cuts, wound and eczema (Kondh/ ST & Tonla/SC).

Acorus calamus L. (Acoraceae); Jaisanda, Devosando; Waj Turki; Burbi RF-10905; Rhizome; Diarrhea, dysentery and indigestion; Decoction of rhizome is used for diarrhea, dysentery and indigestion in children (Kondh/ST).

Aegle marmelos Corr. (Rutaceae); Bel; Belgiri, Safarjal-e-Hindi; Pudoh RF-10925; Leaves; Gastric problem, diarrhea, dysentery; Leaves decoction is used for gastric problem. Fruit pulp is taken to cure diarrhea and dysentery (Kondh/ST).

Aerva lanata (L.) Juss. ex Schults. (Amaranthaceae); Pichhudi Sago; Biseributi; Kupmundia Forest-10945; Cough; Whole plant; About one teaspoon powder of whole plant is used to cure cough (Kondh/ST & Paradhan/Other villagers).

Andrographis paniculata (Burm.f.) Nees (Acanthaceae); Bhuineem; Kalmegh; Arakhapadar RF-10847; Leaves, whole plant; Vermifuge, cough, diarrhea, malarial fever, itching, blood purification, diabetes; Leaves paste is taken with water as vermifuge in empty stomach. Decoction of whole plant is used to cure cough, diarrhea and malarial fever. Leaves paste is applied for itching. Whole plant extraction or powder is used for blood purification, diabetes and malaria (Kondh/ST).

Argemone mexicana L. (Asteraceae); Nirpania; Satyanasi; Jhadarajing-10870; Seed; Iitching, wound, scabies, eczema; Seed paste with mustered oil applied for itching and wound. Root paste is applied to cure scabies and eczema (Kondh/ST).

Asparagus racemosus Willd. (Liliaceae); Gaichira, Satabari; Shaqaqul, Satawar; Kutnijharo-10856; Root; Stomachache, dyspepsia, acidity, spermatorrhea, leucorrhoea, menstruation problem, diabetes; Root paste with mishri (rock sugar)

is taken for stomachache and dyspepsia. One teaspoon root powder with cow milk is taken for dyspepsia and acidity. Root bark immersed in water for whole night and next morning paste of bark with mishri (rock sugar) taken empty stomach for spermatorrhea. Root powder of plant mixed with root powder of 'Aswaganha' (*Withania somnifera* (L.) dunal) in equal quantity and about one teaspoon is taken to cure leucorrhoea, menstruation problem and spermatorrhea problem. Roots powder of *Asparagus racemosus* Willd., Ashwagandha (*Withania somnifera* (L.) dunal), Gokharu (*Tribulus terrestris* L.), Bidonko (*Mucuna prurita* Hook.), Talmuli (*Curculigo orchioides* Gaertn.), Ambla (*Phyllanthus emblica* L.), Koilikhia (*Hygrophilla auriculata* (Schum.) Heine) mix all in equal quantity and added some mishri (rock sugar). One teaspoon of this herbal preparation taken for spermatorrhea and without mishri taken for diabetes (Tonla/SC, Kondh/ST).

Atylosia scarabaeoides (L.) Benth. (Fabaceae); Bankulthi; Arakhapadar RF -10843; Root; Diarrhea; About one table spoon of root paste is taken to cure diarrhea (Kondh/ST).

Azadirachta indica A. Juss. (Meliaceae); Nimbo; Neem; Badalasahi-10887; Leaves; Skin infection & eczema; Leaves paste is applied for skin infection and eczema (Kondh/ST).

Bixa orellana L. (Bixaceae); Kamlagundi; Biranarsinghpur Nursery -10961; Leaves; Blister, boils, eczema; Leaves paste is applied on skin problems such as blister, boils & eczema (Kondh & Tonla).

Buchanania lanzan Spreng. (Anacardiaceae) syn. *Buchanania latifolia* Roxb.; Charogachha; Chironji; Pudoh RF-10921; Seed and Gum; Cut, wounds & toothache; Seeds paste used on cut and wounds. Gum is applied for tooth ache (Jena/SC & Kondh/ST).

Butea monosperma (Lam.) Taub. syn. *Butea frondosa* Koen. ex Roxb. (Fabaceae); Marda, Bhuikakheru; Dhak, Tesu; Kupmundia Forest-10942; Flower and seed; Scabies, eczema, diarrhea, dysentery & blood pressure; Paste of flower is applied on scabies and eczema problem. About one small teaspoon seed powder is taken to cure diarrhea and dysentery. Decoction of flower is taken for blood pressure (Paradhan /Other villagers).

Butea superb Roxb. (Fabaceae); Buduli, Phalsa; Burbi RF-10906; Flower; gastric problem; Flower powder mixed with leaves powder of Belpatra (*Aegle marmelos* Corr.) and leaves powder of Neemo (*Azadirachta indica* A. Juss.) in equal quantity. One teaspoon powder is taken for gastric problem (Kondh/ST).

Capparis zeylanica L. (Capparaceae); Asadhua; Arakhapadar RF-10831; Fruit; Diabetes; Fruit powder is used for diabetes (Kondh/ST).

Careya arborea Roxb. (Lecythidaceae); Kumbhi; Kumbhi, Baukhamba; Madhapur-10888; Bark; Dysentery and skin infection; Bark decoction used to cure dysentery. Paste of bark paste is applied for skin infection (Kondh/ST).

Caryota urens L. (Arecaceae); Salpo; Pudoh RF-10929; Plant sap; General weakness and constipation; Plant sap (Toddy) is consumed to cure constipation and as a tonic for general weakness (Kondh/ST).

Centella asiatica (L.) Urban (Apiaceae); Thalkundi; Brahmi; Pudoh RF-10912; Leaves and root; Blood pressure and to increase memory; One teaspoon leaves paste with honey taken empty stomach to boost memory. Leaves powder of plant with root of Patalgarud (*Rauvolfia tetraphylla* L.) and 5-6 Black pepper (*Piper nigum* L.) powder made tablet with honey and one tablet taken for high blood pressure daily (Kondh/ST).

Chromolaena odorata (L.) King & H. Robins (Asteraceae); Poksunga; Tikirasahi-10849; Leaves; Cuts , wounds; Paste of leaves is used on cuts and wounds for healing (Sahu/Other villagers)

Chrozophora rottleri (Geiseler) A. Juss. ex Spreng. (Euphorbiaceae); Bono-chaturi; Bandigado-10852; Fruit; skin itching, rashes, swelling and joint pain; Paste of dried fruit made with water, & warms it slightly, than applied it for skin itching and rashes problem. Paste also applied on swelling & joint pain and covers it with bandage. The process is repeated till cure (Jhankar / Other villagers).

Cleistanthus collinus (Roxb.) Benth. ex Hook.f. (Euphorbiaceae); Korda; Stomach inflammation in cattle; Arakhapadar RF-10846; Leaves; Dried leaves smoke inhaled for stomach inflammation in cattle (Kondh/ST).

Clerodendrum viscosum Vent. (Verbenaceae); Bhat; Pudoh RF-10914; Leaves; Diabetes, rheumatic arthritis, blood pressure, toothache, pyorrhea; Take about 15-20 ml leaves extraction of plant and added 5-6 Black pepper seed (*Piper nigrum* L.) powder and the preparation is taken to cure diabetes. Root powder is also taken to cure rheumatic arthritis. Flower decoction is used for toothache and pyorrhea. Hat woven leaves of 'Bhat' do wear during summer to control blood pressure (Kondh/ST).

Coccinia grandis (L.) Voigt. (Cucurbitaceae); Kanduri; Adenigarh-10932; Leaves; Jaundice; About one table spoon leaves extraction is taken to cure jaundice (Kondh/ST).

Cocculus hirsutus (L.) Diels (Menispermaceae); Dahidahia/Budhbudhia; Tan, Jaljamni; Arakhapadar Reserved Forest (RF)-10829; Whole plant; Headache; Paste of whole plant is applied for headache problem (Kondh/ST).

Cryptolepis buchanani Roem & Schult. (Apocynaceae); Khirkanchan; Bandigado-10853; Root; Lactation; About 5-10 gm root paste is taken for lactation two times in a day (Jhankar/ Other villagers).

Cycas circinalis L. (Cycadaceae); Arguno; Arakhapadar RF-10835; Seed; Increase sperm count; Seed are roasted in cow ghee and made into powder. One teaspoon powder is taken to increase sperm count (Kondh/ST).

Elephantopus scaber L. (Asteraceae); Tirisira; Kathokuria-10848; Root; Headache, throat cleanses and throat infection; Root paste is applied for headache. Root extraction with honey used as throat cleanses and for throat infection two times in a day (Kondh/ST).

Eryngium foetidum L. (Apiaceae); Bandhania; Digsira-10947; Leaves; Constipation and appetizer; About 20-25 ml leaves extraction is taken for constipation. Leaves chutney is taken as an appetizer (Kondh/ST & Tonla/SC).

Euphorbia hirta L. (Euphorbiaceae); Chittakuti/Dudhi; Dudhi; Kuchupaju-10908; Whole plant; Lactation; Powder of whole plant is used to increase lactation (Kondh/ST).

Feronia elephantum Corr. (Rutaceae); Kaitho; Kaith; Kupmundia Forest-10944; Bark; Fever and health tonic; Bark is boiled in a glass of water on low flame when left half, decoction is taken to cure fever. Fruits juice is taken as a health tonic (Paradhan / Other villagers).

Gardenia gummifera L.f. (Rubiaceae); Khurdau, Khurdu, Ladur; Burbi RF-10900; Leaves; Wound healing in cattle; Leaves powder is used wound healing in cattle (Kondh/ST).

Glinus oppositifolius (L.) Aug. DC. syn. *Mollugo oppositifolia* L. (Molluginaceae); Pitagama; Kupmundia forest-10936; Whole plant; Blister, itching & scabies; Paste of whole plant is applied for skin problem such as blister, itching and scabies (Kondh/ST &Paradhan / Other villagers).

Gmelina arborea Roxb. (Verbenaceae); Gambhari; Kutigarh-10826; Root; Cough, rheumatoid arthritis and acidity; Root powder of plant mixed with root powder of Bel (*Aegle marmelos* Corr.), root powder of Phanfana (*Oroxylum indicum* (L.) Vent.) in equal quantity and one teaspoon powder is taken to cure cough, rheumatoid arthritis and acidity (Gond, Kondh/ST).

Hedyotis diffusa Willd (Rubiaceae); Surphulo; Jhadarajing-10868; Whole plant; vitiligo and jaundice; Paste of whole plant with mustered oil applied for vitiligo problem. Extraction of whole plant is used to cure jaundice problem (Kondh /ST & Bahera/ Other villagers).

Helicteres isora L. (Sterculiaceae); Murmuri; Marorphali; Pudoh RF-10911; Fruit; Body and joint pain; Fruit powder with warm mustered oil massage for body and joint pain (Kondh/ST).

Hemidesmus indicus (L.) R. Br. ex Schult (Periplocaceae); Anatmuli; Ushba-e-Hindi; Arakhapadar RF-10844; Root; Spermatorrhea and urinary infection; Root paste or decoction is taken for spermatorrhea and urinary infection (Kondh/ST).

Holarrhena pubescens (Buch. - Ham.) Wall. ex. G. Don. syn. *Holarrhenaan tidysenterica* Wall. (Apocynaceae); Kurai; Kurchi, InderjoTalkh, Tewaj; Kutigarh -10825; Seed and root; Indigestion, rheumatoid arthritis; About 10-15 gm seeds are mixed with 5-7 seeds of Black pepper (*Piper nigrum* L.) and ground into powder. One teaspoon powder is taken for indigestion. Decoction of seed with black pepper is also used for indigestion. Root decoction is used for rheumatoid arthritis (Gond/ST).

Ixora pavetta Andr. (Rubiaceae); Telkurma; Adipadar-10828; Bark; Jaundice; Bark boiled in one litter water till ¼ left. After cooling decoction is taken for jaundice (Kondh/ST).

Jatropha gossypiifolia L. (Euphorbiaceae); Lankajada; Pudoh RF-10919; Mouth ulcer, dysentery, burn, cuts, wound; Latex, seed, fruit; Latex is applied for mouth ulcer, burn, cuts and wound; Seed powder is used for dysentery. Fruit extraction or juice is applied on burn (Jena/SC & Kondh/ST).

Justicia adhatoda L. (Acanthaceae); Basongo; Suaal, Hasheeshatul, Bansa, Arusa; Kuchupaju-10909; Leaves; Cold/cough; Half cup leaves decoction of plant with 5-6 Black pepper (*Pipper nigrum* L.) powder is taken to cure cold and cough (Kondh/ST).

Lannea coromandelica (Hautt.) Merr. (Anacardiacea); Moia, Dhoka; Pudoh RF-10928; Leaves; Body pain, skin rashes bruises & cut; Leaves paste is use for body pain and skin problem such as skin rashes, bruises and cuts (Kondh/ST).

Lygodium flexuosum (L.) Sw. (Lygodiaceae); Latabari; Kutnijharo-10855; Rhizome; Dysentery and diarrhea; Rhizome paste with powder of three black pepper (*Piper nigrum* L.) is taken to cure diarrhea and dysentery (Tonla /SC)

Madhuca indica J. F. Gmel syn. *Bassia latifolia* Roxb. (Sapotaceae); Mahul; Gul-e-Chakan, Mahua; Arakhapadar RF-10834; Bark; Dysentery and diarrhea, eczema, scabies, wound healing; About 30-40 ml bark decoction of plant with one teaspoon honey is taken orally two times in a day to cure dysentery and diarrhea. Paste of bark is applied for skin problem such as eczema, scabies & wound healing (Kondh/ST).

Mallotus philippensis (Lam.) Müll. Arg. (Euphorbiaceae); Phongu, Gundi, Sinduri; Kambil, Kamel; Burbi RF-10892; Fruit red powder; Wound healing; Paste of red powder obtained from fruit is applied on wound for healing in children (Kondh/ST).

Melia azedarach L. (Meliaceae); Common; Mahaneem; Bakain; Bhimkhul-10861; Leaves; to kill lice and vermifuge; Extraction of leaves used to kill head lice. Leaves and fruit decoction is used as vermifuge (Tonla/SC & Nayak/Other villagers).

Mitragyna parvifolia (Roxb.) Korth. (Rubiaceae); Mundi, Jangli kadam; Gadimunda-10955; Root; Pimples, sore, boils; Root paste is applied to cure skin problem such as pimples, sore and boils (Kondh/ST & Tonla/SC).

Naringi crenulata (Roxb.) Nicolson (Rutaceae); Bhanta, Bamber; Burbi RF-10907; Root; Joint pain; Root decoction is used for joint pain (Kondh/ST).

Ocimum canum Sims. syn. *Ocimum americanum* L. (Lamiaceae); Nandabagudi; Bahali-10850; Seed, leaves; Eye complaint and to kill lice; Seeds are placed in eye to remove impurities such as foreign particles, to treat redness etc. Leaves paste is applied on scalp to kill lice (Jhankar / Other villagers).

Phyllanthus reticulatus Poir. syn. *Kirginelia reticulata* (Poir.) Baill. (Euphorbiaceae); Jojang; Gadimunda-10956; Leaves; Headache, cuts, wounds & sores; Leaves paste is applied for headache. Paste of leaves is applied locally to cure cuts, wounds and sores (Kondh/ST).

Plumeria rubra L. syn. *Plumeria acutifolia* Poir. (Apocynaceae); Kath champa; Pudoh RF-10924 Leaves; Vermifuge & joint pain; Leaves extraction is used as vermifuge. Leaves paste applied for joint pain (Kondh/ST).

Pterocarpus marsupium Roxb. (Fabaceae); Piasar; Bajasar, Piasal; Pudoh RF-10913; Root; joint pain; Root powder is used for joint pain (Kondh/ST).

Punica granatum L. (Punicaceae); Dalimbo; Anar; Indigestion & bloating stomach; Pudoh RF-10916; Fruit ; Unrippen fruit powder with Black pepper (*Piper nigrum*) is taken for indigestion and bloating stomach (Kondh/ST).

Santalum album L. (Santalaceae); Safed chandan; Sandal Sufaid; Biranarsinghpur Nursery-10962; Wood; Headache, wounds, sores, boils, pimples & burn; Paste of wood is applied on wounds, sores, boils, pimples burn to protect from infection and for headache (Kondh/ST)

Schleichera oleosa (Lour.) Oken. (Sapindaceae); Kusum; Kusum; Arakhapadar RF-10836; Seed; Itching; Seed oil massage for itching problem (Kondh/ST).

Shorea robusta Gaertn. (Verbenaceae); Salo; Sal; Arakhapadar RF-10841; Flower; Leucorrhoea, burn, cuts & wounds; Flower. A handful dried flower ground

into powder with 5-7 seed of Black pepper (*Piper nigrum* L.). One teaspoon of herbal preparation is taken daily to cure leucorrhoea. Resin obtained from plant used on burn, cuts and wounds (Kondh/ST).

Solanum surattense Burm.f. (Solanaceae); Bejibangan; Bahali-10851; Fruit; Cough, cold and asthma; Dried fruit paste or powder of plant is used for treatment of cough, cold and asthma (Jhankar /Other villagers).

Soymida febrifuga (Roxb.) A. Juss. (Meliaceae); Rohini; Arakhapadar RF-10830; Bark; Rheumatoid arthritis and acidity; Bark boil in about 100 ml water, when left one quarter, add one teaspoon honey. The decoction is given to cure rheumatoid arthritis and acidity (Kondh/ST).

Sphaeranthus indicus L. (Asteraceae); Indrobhita/Bonokadam/Bhuikadam/Mundi; Mundi; Arakhapadar RF-10845; Flower, Root; Boil, urinary infection, dyspepsia; Paste of flower head is applied to treat boil. Root decoction is used for urinary infection and dyspepsia (Kondh/ST).

Syzygium cumini (L.) Skeels (Myrtaceae); Jamukoli; Jamun; Digsira-10953; Bark and seed; Diarrhea, dysentery and diabetes; About one teaspoon bark powder is taken twice in a day to cure diarrhea and dysentery. About one teaspoon seed powder is taken with water in empty stomach to cure diabetes twice in a day (Kondh/ST).

Tephrosia purpurea (L.) Pers. (Fabaceae); Kulthia; Sarphoka; Root ; Stomachache; Baring-10880; About 5-6 gm root powder with 3-5 black pepper (*Piper nigrum* L.) powder is used for all type of stomachache (Kondh/ST).

Terminalia catappa L. (Combretaceae); Pestabadam; Janglibadam; Rangamatia-10933; Leaves; Skin allergy; Leaves extraction is applied for skin allergy (Kondh/ST).

Tinospora cordifolia (Willd.) Hook.f. & Thoms. (Menispermaceae); Gumbchi; Gilo; Pudoh RF-10917; Anemia, diabetes, gastric problem, joint pain, headache; Stem; Stem immersed in water for whole night in half glass of water and equal quantity of young wheat leaves extraction mixed in it. This herbal remedy is taken for anemia, diabetes, gastric and joint pain. Whole plant immersed or boiled in water on low flame. The decoction is taken for headache (Jena/SC & Kondh/ST).

Tridax procumbens L. (Asteraceae); Vishkarni; Zakhm-e-Hayat; Gadimunda-10954; Leaves; Cuts, wounds, burn, fever, cough and vermifuge; Leaves extraction is used on cuts, wounds and on burn for healing purpose. About 20 ml leaves extraction with half teaspoon honey is taken for 2-3 times in a day to cure fever, cough and as a vermifuge. About 20 ml leaves extraction mixed with half teaspoon ginger juice and half teaspoon honey and the preparation is taken to cure fever twice in a day (Kondh/ST).

Vanda tessellata (Roxb.) Hook. ex G. Don. syn. *Vanda roxburghii* R. Br. (Orchidaceae); Rasna; Bhimkhul-10860; Whole plant and leaves; joint pain, fever, bone fracture; Paste of whole plant is applied for joint pain and fever. Leaves paste is applied for bone fractures (Tonla/SC, & Nayak/ Other villagers).

Woodfordia fruticosa (L.) Kurz. (Lythraceae); Arakhapadar RF-10837; Jhatki/ Dhatuki; Gul-e-Dhawa; Root, flower; Cuts, wounds, piles, joint pain, gastric problem, diabetes; Root paste of plant is used for healing purpose on cuts and wounds. About one teaspoon root powder is taken for piles. Root powder of plant mixed with root powder of 'Hadkankdia' (*Ardisia solanacea* Roxb.) in 2:1 ratio and with cow ghee (clarified butter) powder massage for joint pain. Flower powder of plant mixed with powder of Triphala (Fruit powder of *Phyllanthus emblica* L., *Terminalia chebula* Retz. and *Terminalia bellirica* (Gaertn.) Roxb.), powder of Sonth (dried rhizome of *Zingiber officinale* Roscoe) in 2:1:1 ration and added 5-7 seed powder of Blackpepper (*Piper nigrum* L.) and one teaspoon of this herbal remedy is given for gastric and diabetic problem (Kondh/ST).

Figure 1 (i-xii): Some Ethnomedicinal Plants of Boudh District

i) *Bixa orellana* L.; ii) *Butea superb* Roxb.; iii) *Cycas circinalis* L.; iv) *Eryngium foetidum* L.; v) *Haldina cordifolia* (Roxb.) Ridsd; vi) *Ixora pavetta* Andr.; vii) *Lannea coromandelica* (Hautt.) Merr.; viii) *Madhuca indica* J. F. Gmel; ix) *Santalum album* L.; x) *Shorea robusta* Gaertn.; xi) *Soymida febrifuga* (Roxb.) A. Juss.; xii); *Tinospora cordifolia* (Willd.) Hook.f. & Thoms

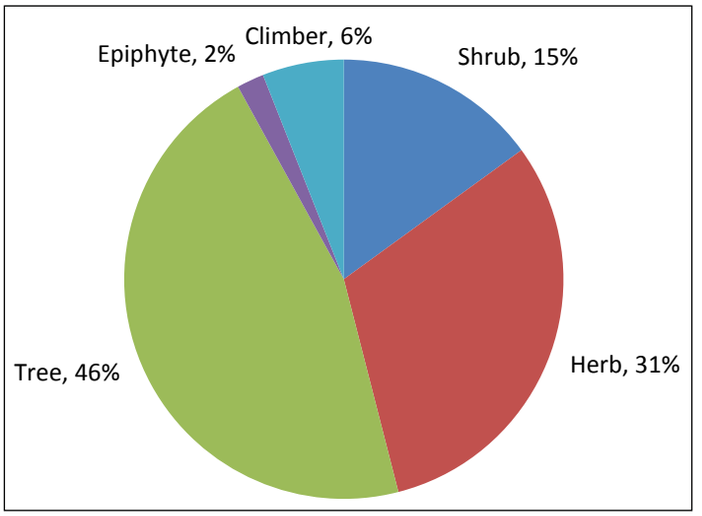

Figure 2: Showing habit pattern of different plant species

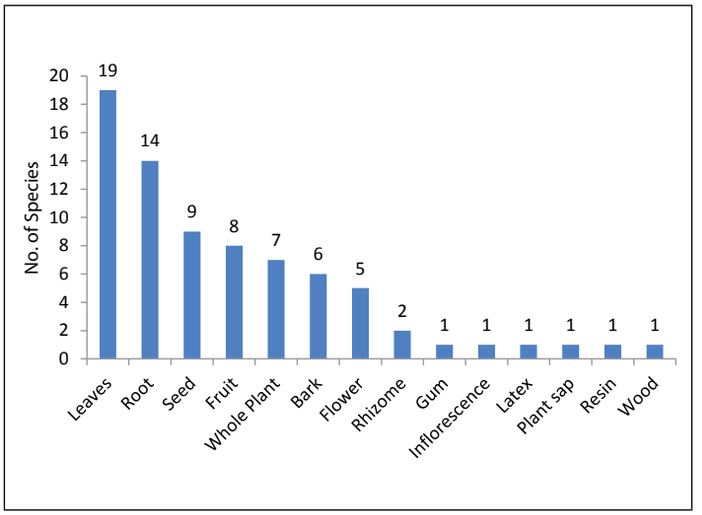

Figure 3: Different parts of medicinal plants were used for herbal preparation

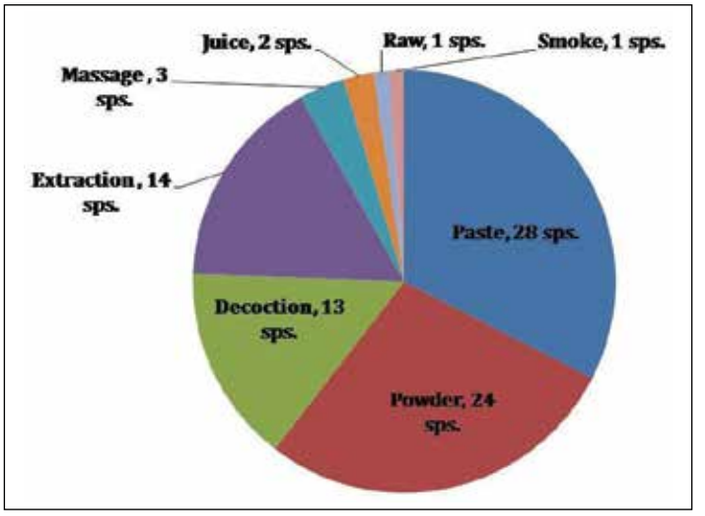

Figure 4: Method of preparation

Table 1: Ethno-medicinal plant species used to treat ailment within different ailment categories

S.No.	Ailment category	Ailment	Number of plant species to cure ailment
1.	Dermatological conditions	Eczema, scabies, wound, cut, itching burn, boil, rashes, vitiligo, skin infection, bruises, skin allergy, blister, pimples, sore, blood purification	*Acalypha indica* L., *Achyranthes aspera* L., *Andrographis paniculata* (Burm.f.) Nees, *Argemone mexicana* L., *Azadirachta indica* A. Juss., *Bixa orellana* L., *Butea monosperma* (Lam.) Taub., *Buchanania lanzan* Spreng., *Chromolaena odorata* (L.) King & H. Robins, *Chrozophora rottleri* (Geiseler) A. Juss. ex Spreng., *Careya arborea* Roxb., *Gardenia gummifera* L.f., *Glinus oppositifolius* (L.) Aug. DC., *Hedyotis diffusa* Willd, *Jatropha gossypiifolia* L., *Lannea coromandelica* (Hautt.) Merr., *Madhuca indica* J. F. Gmel, *Mallotus philippensis* (Lam.) Müll. Arg., *Mitragyna parvifolia* (Roxb.) Korth., *Phyllanthus reticulatus* Poir., *Schleichera oleosa* (Lour.) Oken., *Shorea robusta* Gaertn, *Sphaeranthus indicus* L., *Terminalia catappa* L., *Tridax procumbens* L., *Santalum album* L., *Woodfordia fruticosa* (L.) Kurz., (27 sps.).

S.No.	Ailment category	Ailment	Number of plant species to cure ailment
2.	Gastro-intestinal diseases	Indigestion. Dysentery, diarrhea, piles, gastric /acidity problem, dyspepsia, vermifuge, stomachache, bloating stomach , constipation, appetizer	*Acorus calamus* L.; *Aegle marmelos* Corr.; *Asparagus racemosus* Willd., *Atylosia scarabaeoides* (L.) *Benth..*, *Butea monosperma* (Lam.) Taub., *Butea superb* Roxb., *Careya arborea* Roxb., *Caryota urens* L., *Eryngium foetidum* L., *Gmelina arborea* Roxb., *Holarrhena pubescens* (Buch. - Ham.) Wall. ex. G. Don., *Jatropha gossypiifolia* L., *Lygodium flexuosum* (L.) Sw., *Madhuca indica* J. F. Gmel, *Melia azedarach* L., *Plumeria rubra* L., *Punica granatum* L., *Soymida febrifuga* (Roxb.) A. Juss., *Sphaeranthus indicus* L., *Syzygium cumini* (L.) *SkeelsTephrosia purpurea* (L.) Pers., *Tinospora cordifolia* (Willd.) Hook.f. & Thoms., *Tridax procumbens* L., *Woodfordia fruticosa* (L.) Kurz., *Cleistanthus collinus* (Roxb.) Benth. ex Hook.f. (26 sps.)
3.	Muscular/ skeletal	Rheumatoid arthritis, headache, joint pain, swelling, bone fracture, body pain	*Holarrhena pubescens* (Buch. - Ham.) Wall. ex. G. Don., *Gmelina arborea* Roxb., *Cocculus hirsutus* (L.) Diels, *Soymida febrifuga* (Roxb.) A. Juss., *Woodfordia fruticosa* (L.) Kurz., *Chrozophora rottleri* (Geiseler) A. Juss. ex Spreng, *Elephantopus scaber* L., *Vanda tessellata* (Roxb.) Hook. ex G. Don., *Naringi crenulata* (Roxb.) Nicolson, *Helicteres isora* L., *Pterocarpus marsupium* Roxb., *Clerodendrum viscosum* Vent., *Tinospora cordifolia* (Willd.) Hook.f. & Thoms., *Plumeria rubra* L., *Lannea coromandelica* (Hautt.) Merr., *Phyllanthus reticulatus* Poir., *Santalum album* L. (17 sps.)

S.No.	Ailment category	Ailment	Number of plant species to cure ailment
4.	Endocrine	Diabetes	*Capparis zeylanica* L., *Woodfordia fruticosa* (L.) Kurz., *Andrographis paniculata* (Burm.f.) Nees, *Asparagus racemosus* Willd., *Tinospora cordifolia* (Willd.) Hook.f. & Thoms., *Syzygium cumini* (L.) Skeels,, *Clerodendrum viscosum* Vent. (7 sps.)
5.	Respiratory	Cough, cold and asthma	*Gmelina arborea* Roxb., *Andrographis paniculata* (Burm.f.) Nees, *Solanum surattense* Burm.f., *Justicia adhatoda* L., *Aerva lanata* (L.) Juss. ex Schults., *Tridax procumbens* L. (6 sps.)
6.	Reproductive disorders	Spermatorrhea, increase sperm count, lactation, leucorrhoea, menstruation problem	*Cycas circinalis* L., *Shorea robusta* Gaertn, *Hemidesmus indicus* (L.) R. Br. ex Schult , *Cryptolepis buchanani* Roem & Schult., *Asparagus racemosus* Willd., *Euphorbia hirta* L. (6 sps.)
7.	Circulatory system	Blood pressure, anemia	*Centella asiatica* (L.) Urban, *Clerodendrum viscosum* Vent., *Tinospora cordifolia* (Willd.) Hook.f. & Thoms., *Butea monosperma* (Lam.) Taub. (4 sps.)
8.	Fever	Malarial fever, common fever	*Andrographis paniculata* (Burm.f.) Nees, *Vanda tessellata* (Roxb.) Hook. ex G. Don., *Feronia elephantum* Corr., *Achyranthes aspera* L. (4 sps.)
9.	Liver complaint	Jaundice	*Ixora pavetta* Andr., *Hedyotis diffusa* Willd, *Coccinia grandis* (L.) Voigt. (3 sps.)
10.	Dental care	Toothache, pyorrhea, tooth cavity, tooth infection	*Clerodendrum viscosum* Vent., *Buchanania lanzan* Spreng., *Achyranthes aspera* L. (3 sps.)
11.	Renal complaint	Urinary infection	*Hemidesmus indicus* (L.) R. Br. ex Schult, *Sphaeranthus indicus* L. (2 sps.)
12.	Hair care	To kill lice	*Ocimum canum* Sims., *Melia azedarach* L. (2 sps.)
13.	ENT	Throat cleanses and throat infection	*Elephantopus scaber* L. (1 sps.)
14.	Eye complaint	Eye problem	*Ocimum canum* Sims. (1 sps.)

S.No.	Ailment category	Ailment	Number of plant species to cure ailment
15.	Other use	Mouth ulcer, increase memory, General weakness, Health tonic	*Jatropha gossypiifolia* L., *Centella asiatica* (L.) Urban, *Caryota urens* L., *Feronia elephantum* Corr. (4 sps.)

Discussion

The present study makes an attempt to focus on the age old therapeutic methods currently employed by the tribal and rural people of Boudh forest division. It was found that a total 65 plant species (64 species of angiosperm and one species of pteridophyte) belonging to 35 families and 64 genera are commonly used to cure various ailments (Figure 1). Based on life forms there are 46 % tree, 31% herbs, 15 % shrub, 6% climber and 2% epiphyte (Figure 2). Most dominant family was Euphorbiaceae (7 sps. each) followed by Fabaceae & Asteraceae (5 sps. each), Rubiaceae (4 sps.), Apocynaceae, Meliaceae, Rutaceae, Verbenaceae (3 sps each). Rests of families were represented by two or one species. These plants were used to cure 58 different ailments viz. wound healing (13 sps.), dysentery, diarrhea, cuts (9 sps. each), gastric/acidity problem (8 sps.), cough, eczema (6 sps each), rheumatoid arthritis, headache, joint pain, scabies, itching (5 sps. each), indigestion, burn (4 sps.), blood pressure, boil, sore, fever , jaundice (3 each), dyspepsia, vermifuge, stomachache, constipation, appetizer, cold, leucorrhoea, spermatorrhea, lactation, body pain, rashes, skin infection, blister, pimples, urinary infection, toothache, to kill lice veterinary (2 each), piles, bloating stomach, anemia , throat cleanses and throat infection, asthma, increase sperm count, menstruation problem, swelling, bone fracture, blood purification, vitiligo, bruises, skin allergy, malarial fever, pyorrhea, tooth cavity, tooth infection , eye complaint, increase memory, mouth ulcer, general weakness, health tonic (1 sps. each). These ailments were grouped under 15 ailment categories where maximum species were used to cure dermatological conditions followed by gastro-intestinal diseases. muscular/skeletal, endocrine etc. (Table 1). Two species viz. *Cleistanthus collinus* (Roxb.) Benth. ex Hook.f. and *Gardenia gummifera* L.f. were used for veterinary use. Different plant parts were used for herbal preparation. Leaves (19 sps.) were most frequently used for the treatment of diseases followed by root (14 sps.) seed (9 sps.), fruit (8 sps) etc. (Figure 3). Use of leaves and roots for management and treatment of diseases has been an age long practice (Sofowara, 1982). The methods of preparation of herbal remedy fall into eight categories viz. plant parts applied as a paste (28 sps.), dried plant part powder (24 sps.), decoction (13 sps.), extraction (14 sps.) & juice (2 sps.) from the fresh plant parts, massage (3 sps.), one species consumed raw as chutney and smoke of one species used in veterinary (Figure 4). Hat woven leaves of *Clerodendrum viscosum* Vent. wear during summer

to control blood pressure. External applications (mostly for dermatological conditions and muscular/skeletal problem) and internal consumption (mostly for gastrointestinal, diabetes, circulatory, liver complaint etc.) of the preparations were involved in the treatment of various diseases. Herbal medicines prescribed by local healers are either the preparations based on single plant part or sometimes a combination of several plant parts were used to cures diseases rapidly e.g. *Holarrhena pubescens* (Buch. - Ham.) Wall. ex. G. Don., *Gmelina arborea* Roxb., *Shorea robusta* Gaertn., *Lygodium flexuosum* (L.) Sw., *Tephrosia purpurea* (L.) Pers., *Clerodendrum viscosum* Vent., *Woodfordia fruticosa* (L.) Kurz., *Asparagus racemosus* Willd. *Butea superb* Roxb. *Centella asiatica* (L.) Urban, *Achyranthes aspera* L., *Punica granatum* L. were included other species plant part to made herbal remedy. These remedies were also prepared using different ingredients of non-plant origin such as water, honey, clarified butter, cow milk etc.

Comparing the present study with available literature of the state and other part of country (Ambasta, 1986; Aminuddin *et al*., 2013; Aminuddin and Girach, 1991, 1993, 1996; Aminuddin and Ahmad, 2008, Anonymous, 2001 & 2006; Ayyanara and Ignacimuthu, 2005 & 2011; Behera *et al*., 2006, 2008; Das and Choudhury, 2012; Dhal *et al*., 2014; Girach, 1992; Girach *et al*., 2008; Jain, 1991; Kandari *et al*., 2012; Khongsai *et al*., 2011; Kirtikar and Basu, 1935; Majumdar *et al*., 2006; Mallik *et al*., 2012; Mukesh *et al*., 2011, 2012, 2014a&b.; Muthu *et al*., 2006; Nadkarni, 1954; Panda, and Das, 1999; Panda *et al*., 2013; Panghal *et al*., 2010; Pandey and Rout, 2006; Patra *et al*., 2014; Prusti. and Behera, 2007; Raut *et al*., 2013; Rout *et al*, 2009 a & b; Sahu *et al*., 2010, 2013a, b & c; Sarkar *et al*., 1999; Satapathy, 2010, 2015; Satapathy and Brahmam, 1999; Satapathy & Chand, 2003; Satapathy, 2010 & 2015; Satapathy, *et al*., 2012; Sinhababu and Banerjee, 2013; Usha *et al*., 2014, 2015a & b, 2016a, b & c) it has been found that most of the folk-medicinal claims reported in the present study are already known, however, their mode of application, ingredients and parts used are different. Therefore, present work represents contemporary uses of medicinal plants by the tribals of the study area. Some information recorded in the study particularly for *Clerodendrum viscosum* Vent., *Cryptolepis buchanani* Roem & Schult., *Elephantopus scaber* L., *Hedyotis diffusa* Willd., *Ixora pavetta* Andr., *Naringi crenulata* (Roxb.) Nicolson, *Tridax procumbens* L. were found to be either not known or little known, whereas use of species such as *Achyranthes aspera* L., *Acorus calamus* L., *Aegle marmelos* Corr., *Aerva lanata* (L.) Juss. ex Schults., Argemone mexicana L., Azadirachta indica A. Juss., Centella asiatica (L.) Urban, *Chromolaena odorata* (L.) King & H. Robins , *Holarrhena pubescens* (Buch. - Ham.) Wall. ex. G. Don. , *Jatropha gossypiifolia* L., *Justicia adhatoda* L., *Madhuca indica* J. F. Gmel, *Melia azedarach* L., *Tephrosia purpurea* (L.) Pers. were found to be used very common by other tribes indicating the authenticity of their usefulness. It would be worthwhile to subject all these folk-medicinal claims

to scientific investigations through pharmacological and clinical studies. It is likely that through such investigations new drugs of natural origin may be discovered for treatment of many of the diseases for which there are no satisfactory cures in modern system of medicine.

It has also been observed that a large population of the district is still largely depends on medicinal plants for primary health care system. Tribal and rural people have vast knowledge of traditional remedy and used plenty of medicinal plants to treat a wide spectrum of human ailments. During interviews conducted in different villages, it has been observed that knowledge of medicinal plants is limited to traditional healers, herbalists and elderly persons who are living in rural areas. This knowledge is rapidly dwindling in number and there is a grave danger of traditional knowledge disappearing due to lack of interest among the younger generation as well as their tendency to migrate to cities for lucrative jobs, there is a possibility of losing this wealth of knowledge in the near future. Therefore, it is necessary to acquire and preserve this traditional system of medicine by proper documentation and identification of specimens which can also help to boost new innovations in the pharmaceutical industry and have many beneficial applications such as new medicinal trails for some diseases like malaria, diabetes, which will develop the health care sector in India.

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Pharmacognostic Studies on Leaf Drugs - Bibliographic Review#

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Abstract

Pharmacognostic studies on herbal drugs contribute diagnostic characteristics for the identification and authentication of drugs. This review communicate the bibliography on Indian publications (pharmacopoeia, monographs, books etc.) pertaining to pharmacognostic profiles of leaf drugs. This review is presented in bibliographic format to cite the references on pharmacognosy of leaf drugs. These bibliographic references are important for developing quality standards, drug standardization, monographs etc. Bibliographies are 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 leaf drugs, Herbal drugs.

Introduction

Indian health care system (Ayurvedic, Siddha, Unani and Homoeopathic systems of medicine) has major source of medicines having ingredients from herbal drugs. The herbal drugs are various morphological parts of medicinal plant species viz. leaves, stem, root, barks, heartwood, flowers, fruits, seeds and various exudates. These are collected and resourced by the manufactures to formulate the medicines for 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 'leaf drugs' refer to dried leaves as whole or their parts, i.e., laminae or separate lobes of compound leaves. Generally leaf drugs morphologically resemble each other which lead to confusion leading to fair chances for adulteration. Pharmacognostic profiles explain diagnostic characteristics of drug so as to authenticate and differentiate from adulterants or substitutes. Organoleptic characteristics can be observed in leaves, their kind, petiole, lamina, venation, incision, apex, margin, shape and surface characters for identification purposes. The important anatomical parameters to evaluate leaf drugs are epidermis, its cells number of layers, stringations or thickening, presence or absence of stomata, its type, stomatal index, vein islet number, vein termination number, types of trichomes, the thickness of their walls, characters of cuticle covering them, epidermal glands, their structure and contents distribution and location, conceptacles with essential oil or resinous contents, secretary ducks, latex vessels in the leaf mesophyll or along the veins, palisade ratio, non-protoplasmic contents (calcium oxalate

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crystals) in the form of single crystal, druses, rawhides, crystalline sand , and general tissue system leaves.

Bibliographies provide the account of literature published in respective areas so far. Major existing bibliographies on the Pharmacognostic aspects (Iyengar, 1976 and Mitra, 1985) and relevant available sources were consulted (Rai *et al*, 2012 and Tiwari *et al*, 2013). Different Indian pharmacopoeias viz Ayurvedic, Siddha, Unani and Homoeopathic (regulatory standards) and various monographs are listed as these contributions are pertinent to pharmacognostical profiles on herbal drugs which can be referred to evaluate leaf drugs to ensure the identification and quality. Research publications on this aspect are not included in present review.

Bibliographic Review -

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

1. **Pharmacopoeial Review –** Indian Pharmacopoeial publications are regulatory books under Drug & Cosmetic Act 1940 and Rules thereunder. In India, Ayurvedic, Siddha, Unani and Homoeopathic Pharmacopoeias are in purview of drug regulation of the country. Quality standards on herbal drugs comprise standards on identity, purity and strength. Standards on identity of herbal drugs in a pharmacopoeia is prescribed by pharmacognostical profiles viz. macroscopic and microscopic characteristics of herbal drugs and their powders. Pharmacopoeial monographs published on leaf drugs are enumerated in Table -1

Table 1: Pharmacognostic work on leaf drugs in Indian Pharmacopoeial references

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Abies webbiana Lindl.	Talisa	Dried Leaf	API- IV
Abroma augusta Linn. f.	Abroma augusta	Leaf	HPI I&IX
Acacia pennata (L.) Willd.	Adari	Leaf	API- VI
Acalypha indica L.	Harita manjari	Whole plant	API- VI
	Kuppaimeni camulam	Whole plant	SPI-II
	Acalypha indica	Whole plant	HPI-I&VIII
Acer negundo Linn.	Negundium americana	Whole plant	HPI-VII
Achillea millefolium Linn.	Millefolium	Whole plant	HPI-IV

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Achyranthes aspera L.	Apamarga	Whole plant	API- II
	Nayuruvic camulam	Whole plant	SPI-I
	Achyranthes aspera	Whole plant excluding root	HPI-IV
Aconitum lycoctonum Linn.	Aconitum lycoctonum	Whole plant	HPI-VI
Acontium napellus Linn.	Acontium napellus	Whole plant	HPI-I
Adhatoda vasica Nees	Vasa	Leaf	API- I
	Arusa	Leaf	UPI-VI
	Vasaka	Dried mature leaves	IP- 2010
	Vasaka Adulasa; Adhatoda vasica, Vasaka Extract	Extracting of dried mature leaves with suitable solvent	IP- 2014
	Justicia adhatoda	Leaf	HPI-I
Adiantum capillus- veneris L	Bijapatra	Whole plant	API- VI
Adiantum lunulatum Burm.	Hamsapadi	Whole plant	API- III
Adlumia fungosa (Ait.) Greene	Adlumia fungosa	Shoot	HPI-VIII
Adonis vernalis Linn.	Adonis vernalis	Whole plant	HPI-II
Aegle marmelos (Linn.) Cor.	Aegle folia	Leaf	HPI-IV
Aerva lanata (L.) Juss. ex Schult.	Cirupilaic camulam	Whole plant	SPI-I
	Pattura	Whole plant	API- V
Aethusa cynapium Linn.	Aethusa cynapium	Whole plant	HPI- I&VIII
Agave americana Linn.	Agave americana	Leaf	HPI-VI
Agraphis nutans Linn.	Agrarphis nutans	Whole plant	HPI-VI
Alangium salviifolium (L. f.) Wang. Syn. *A. Lamarckii* Thw.	Ankol	Leaf	UPI-V
	Ankolah	Leaf	API- V
Alchemilla vulgaris Linn.	Alchemilla vulgaris	Shoot	HPI-VIII
Alhagi pseudalhagi (Bieb) Desv.	Jawansa	Whole plant	UPI-VI
	Yavasaka	Whole plant	API- II

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Allium ursinum Linn.	Allium ursinum	Whole plant	HPI-VIII
Aloe Barbadensis Mill.	Sibr	Dried leaves	UPI-I
	Kanyasara	Leaf	API- I
	Aloe, Aloes	Dried juice of leaves	IP-96
Alternanthera sessilis (L.) R.Br., ex DC.	Ponnankani	Whole plant	SPI-I
	Matsyaksi	Whole plant	API- II
Amaranthus tricolor L.	Ramasitalika	Whole plant	API- III
Ammi majus Linn.	Ammi majus	Whole plant	HPI-IX
Anagallis arvensis Linn.	Anagalllis arvensis	Whole plant	HPI-IV
Andrographis paniculata Nees	Andrographis paniculata	Whole plant	HPI-I
	Kalmegh	Dried aerial parts, stem and leaves	IP- 2014
Anemone hepatica Linn.	Hepatica triloba	Whole plant	HPI-IX
Anisomeles malabarica (L.) R.Br. ex. Sims.	Sprkka	Whole plant	API- VI
Anthamanta oreoselinum Linn.	Anthamantha oreoselinum	Whole plant	HPI-VI
Anthoxanthum odoratum Linn.	Anthoxanthum odoratum	Whole plant	HPI-IV&VIII
Arctostaphylos uva-ursi Spreng.	Uva ursi	Leaf	HPI-III
Argemone mexicana Linn.	Argemone mexicana	Whole plant	HPI-IX
Aristolochia bracteolata Lam.	Atutintappalai ilai	Leaf	SPI-II
	Kitamari	Leaf	API- VI
Arnica montana Linn.	Arnica montana	Whole plant	HPI-I
Artemesia absinthium Linn.	Absinthium	Leaf and flowers	HPI-II
	Dvipantara damanaka	Whole plant	API- VI
Artemisia abrotanum Linn.	Abrotanum	Leaf and young shoot	HPI- I&IX

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Artemisia annua L.	Artemisia	Dried leaves and flowering tops	IP- 2010
	Artemisia, Artemisia annua	Dried leaves and flowering tops	IP- 2014
Artemisia brevifolia Wall. (*A. maritima* L. forma *rubricaule* Badhwar)	Artemisia	Dried immature leaves, flowerheads	IP- 55
Arundo donax Linn.	Arundo donax	Whole plant	HPI-IX
Asarum europaeum Linn.	Asarum europaeum	Whole plant	HPI-IV
Asclepias curassavica Linn.	Asclepias curassavica	Whole plant	HPI-IX
Asparagus officinalis Linn.	Asparagus officinalis	Young shoots	HPI-V&VII
Asphodelus tenuifolius Cav.	Gandana	Dried leaves	UPI-III
Asteracantha longifolia Nees	Kokilaksa	Whole plant	API- II
	Hygrophilla sfinosa	Whole plant	HPI-IX
Atropa belladonna L. or *A. acuminata* Royle ex Lindley.	Belladonnae herba, Belladonna herb	Leaves and other sub-aerial parts	IP- 55
	Belladonna dry extract	Extract obtained from the dried leaf and flowering	IP- 2014
	Belladonna Herb, Belladonna Leaf	Leaf and flowering top	IP- 2014
	Belladonna tincture	Tincture obtained from belladonna leaf or roots	IP- 2014
	Belladonna Soft Extract	Dried leaf and root	IP- 2014
	Belladonna	Whole plant	HPI-I

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Azadirachta indica A. Juss. Syn. *Melia azadirachta* L.	Veppilai	Leaf	SPI-II
	Neem, Azadirachta indica	Dried leaves	IP- 2014
	Neem	Leaves	UPI-IV
	Neem	Leaf	UPI-II
	Nimba	Leaf	API- II
Bacopa monnieri (L.) Penn. (Wettst)	Brahmi	Whole plant	API- II
	Pirammi valukkai	Whole plant	SPI-I
	Brahmi Extract	Dried leaves and stems	IP- 2014
	Bacopa monnieri	Whole plant	HPI-IX
	Jal Brahmi	Whole plant	UPI-IV
Balsamodendron caudata Mauch	Amragandhi-gugglu	Leaf	API- VI
	Cenkiluvai ilai	Leaf	SPI-II
Baptisia australis (Linn.) R. Br.	Baptisia confusa	Whole plant	HPI-VII
Barleria prionitis Lees.	Sahacara	Whole plant	API- III
Barosma crenulata Linn.	Barosma crenata	Leaf	HPI-V & VII
Barosma serratifolia (Curtie) Wild.	Barosma serratifolia	Leaf	HPI-VII
Bellis perennis Linn.	Bellis perennis	Whole plant	HPI-I & IX
Betula alba Linn.	Betula pendula folia	Leaf	HPI-VIII
Blumea obavata DC.	Blumea odorata	Whole plant excluding roots	HPI-IV
Boerhaavia diffusa L.	Punarnava (Rakta)	Whole plant	API- I
	Mukkirattaic camulam	Whole plant	SPI-I
	Boerhaavia diffusa	Whole plant	HPI-I
	Pinarnava, pinarnaba	Fresh or dried plant	IP- 66
Borago officinalis L.	Gaozaban	Leaf	UPI-II
	Borago officinalis	Leaf	HPI-VIII

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Brachyglottis repens Forest.	Brachylottis repens	Leaf with flower	HPI-V
Brassica oleracea Linn. var. *capitata* Linn.	Brassica oleracea	Leafy bud	HPI-VIII
Caladium segulnum Vent	Caladium seguinum	Whole plant	HPI-IV
Calendula officinalis Linn.	Calendula officinalis	Fresh flowering tops and Leaf	HPI-I
Calluna vulgaris (Linn.) Hull	Calluna vulgaris	Shoot	HPI-VIII
Calotropis procera (Ait.) R. Br.	Aak	Dried leaves	UPI-I
	Arka	Leaf	API- I
Caltha palustris Linn.	Caltha palustris	Whole plant	HPI-V & VIII
Calycopteris floribunda Lam.	Pullani	Leaf	API- V
Camellia sinensis Linn. Kuntze.	Tea, Thea , Cha, The, Tee	Dried leaves	IP- 55
	Caffeina; Caffeine	Dried leaves	IP- 55
	Thea chinesis	Leaf	HPI-V
Canna flaccida Salisb.	Canna	Leaf	HPI-VI & IX
Cannabis sativa L.	Qinnab	Dried leaves	UPI-I
	Vijaya	Leaf	API- I
	Kanca	Leaf	SPI-I
	Cannabis indica	Leaf	HPI-I
Capsella bursa pastoris Moench.	Thlapsi bursa pastoris	Whole plant	HPI-V
Cardiospermum helicacabum Linn.	Cardiospermum helcacbum	Aerial part	HPI-VIII
Carthamus tinctorius L.	Kusumbha	Leaf	API- VI

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Cassia angustifolia (Tinnevelly Senna) or *Cassia senna* L.; *C. acutifolia* Delite; *C. angustifolia* Vahl.	Sennac folium, Senna leaf	Dried leaflets	IP- 66
	Senna	Leaf	HPI-III
	Sana	Dried leaves	UPI-I
	Senna Dry Extract	Leaves or pods	IP- 2014
	Svarnapatri	Leaf	API- I
	Nilavakai ilai	Leaf	SPI-II
	Senna leaf, Cassia leaf; Cassia angustifolia	Dried leaflets	IP- 2014
Castanea sativa Mill.	Castanea vesca	Leaf	HPI-III
Catharanthus roseus Linn.	Catharanthus roseus	Whole plant	HPI-IX
Ceanothus americanus Linn.	Ceanothus americanus	Leaf	HPI-I
Centaurium chielense (Pers.) Druce.	Canchalagua	Whole plant with flower	HPI-VIII
Centella asiatica (L.) Urban	Mandukaparni	Whole plant	API- IV
	Hydrocotyle asiatica	Whole plant	HPI-I
	Mandukaparni Gotu Kola; Centella asiatica	Dried aerial parts	IP- 2014
	Mandukaparni Dry Extract Gotu kola; Centella asiatica	Extracting aerial parts with suitable solvent and evaporation of solvent	IP- 2014
Centipeda minima L. Syn. *C. orbicularis* Lour.	Kundush	Dried whole plant	UPI-III
Cephalandra indica Nand.	Cephalandra indica	Leaf	HPI-IV
Chamomilla recutita (L.) Rauschert.	Chamomilla	Whole plant	HPI-I & V
Cheiranthus cheiri Linn.	Cheiranthus cheri	Whole plant	HPI-VIII
Chelidonium majus Linn.	Chelidonium majus	Whole plant	HPI-I & VIII
Chelone glabra Linn.	Chelone glabra	Whole plant	HPI-IV&VIII
Chimaphila maculata Pursh.	Chimaphila maculata	Whole plant	HPI-VII

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Chimaphila umbellate (Linn.) Barton.	Chimaphila umbellata	Whole plant	HPI- II&VIII
Chrysanthemum indicum L.	Guladaudi	Leaf	API- VI
Cicer arietinum L.	Canaka	Whole plant	API- VI
Cinnamomum camphora (L.) Nees & Ebern; *Ocimum kilimand oscharicum* Gurke (Labiatae)	Camphor	Leaves	IP- 66
Cinnamomum cassia Blume. Syn. *Cinnamomum aromaticum* Nees & Eberm. L.	Cassia oil	Volatile distilled with steam from the leaves and twigs	IP- 66
	Qirfa	Dried leaves	UPI-III
Cinnamomum tamala (Buch. Ham.) Ness. & Eberm.	Sazaj Hindi	Dried mature leaves	UPI-I
	Ilavankap pattiri	Leaf	SPI-I
	Tvakapatra	Leaf	API- I
Cissus quadrangularis L.	Asthisrnkhala	Aerial part	API- VI
	Pirantai	Aerial parts	SPI-II
Citrullus colocynthis Schrad.	Indravaruni	Leaf	API- II
Clematis erecta Linn.	Clematis eracta	Leaf and stem	HPI-IV
Clerodendron infortunatum Gaertn	Clerodendorn infortunatum	Leaf	HPI-VI
Clitoria ternatea L.	Aparajita	Leaf	API- IV
Coccinia grandis (L.) Voigt	Bimbi	Leaf	API- VI
	Kovai ilai	Leaf	SPI-II
Coccinia indica W. & A.	Bimbi	Whole plant	API- III
Coldenia procumbens L.	Tripaksi	Whole plant	API- VI
	Ceruppataic camulam	Whole plant	SPI-II
Coleus amboinicus Lour.	Parnayavani	Leaf	API- VI
	Coleus aromaticus	Leaf	HPI-VI
Comocladia dentata Jacq.	Comocladia dentata	Leaf and bark	HPI-V

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Conium maculatum Linn.	Conicum maculatum	Whole plant	HPI-I
Convallaria majalis Linn.	Convallaria majalis	Whole plant	HPI-II
Convolvulus pluricaulis Choisy	Sankhapuspi	Whole plant	API- II
Copernicia cerifera Mart.	Carnauba Wax	Leaves	IP-96
Cotyledon umbilicus Linn.	Cotyledon umbilicus	Leaf	HPI-VIII
Cuphea viscosissima Jacq.	Cuphea viscosissima	Whole plant	HPI-IX
Cupressus sempervirens Linn.	Cupressus australis	Leafy twigs and unripe cone	HPI-IX
Cuscuta reflexa Roxb.	Aftimoon	Whole plant	UPI-III
Cymbopogon citratus (DC) Stapf.	Kattrna	Whole plant	API- V
Cymbopogon flexuosus Stapf.	Lemon Grass oil, Gandhatrina, Nimbu ghas tail	Steam distillation of the leaves	IP- 2014
Cymbopogon martinii (Roxb.) Wats	Rohisa	Whole plant	API- V
	Izkhar	Whole plant	UPI-V
Cynara scolymus Linn.	Cynara scolymus	Whole plant	HPI-IX
Cynodon dactylon (L.) Pers.	Durva	Whole plant	API- IV
	Cynodon dactylon	Whole plant	HPI-II
Cytisus laburnum Linn.	Cytisus laburnum	Flower and young leaf	HPI-IX
Datisca cannabina Linn.	Datisca cannabina	Aerial parts while flowering	HPI-VIII
Datura metel L.; *D. metel var. fastuosa* Safford	Dhattura	Whole plant	API- IV
	Datura herba, Datura herb	Dried leaves and flowering parts.	IP- 66
Datura stramonium L.	Stramonium	Dried leaves and flowering tops.	IP- 66
	Stramonium	Whole plant	HPI-II

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Dendrophthoe falcata (L.f.) Ettingsh syn. *Loranthus longiflorus* Desr.	Vanda	Leaf	API- V
Desmodium gangeticum DC.	Salaparni	Whole plant	API- VI
Digitalis purpurea Linn.	Digitalis purpurea	Leaf of the Second Year's growth	HPI-I & VII
Draba verna Linn.	Draba verna	Whole plant	HPI-IX
Drosera rotundifolia Linn.	Drosera rotundifolia	Whole plant	HPI-I & IX
Duboisia myoporoides R. Br.	Duboisis myoporoides	Leaf	HPI-V
Echinacea purpurea (Linn.) Moench.	Echinacea purpurea	Whole plant	HPI-IX
Echinocactus williamsii Lem.	Anahalonium lewini	Whole plant	HPI-VI
Eclipta alba (L.) Hassk.	Bhrngaraja	Whole plant	API- II
	Bhringraj, Eclipta alba	Dried whole plant	IP- 2014
	Eclipta alba	Whole plant	HPI-IX
	Bhangra	Whole plant	UPI-IV
Eclipta prostrate L.	Karicalankannic camulam	Whole plant	SPI-II
Eichhornia crassipes (Mart.) Solms.	Eichhornia crassipes	Whole plant	HPI-VIII
Enchinacea angustifolia DC.	Enchinacea angustifolia	Whole plant	HPI-I
Enicostemma axillare (Lam.) A. Raynal	Nahi	Whole plant	API- VI
	Vellarukuc camulam	Whole plant	SPI-II
Epiphagus virginiana (Linn.) Bart.	Epiphagus virginiana	Whole plant	HPI-V
Equisetum hyemale Linn.	Equisetum hvemale	Whole plant	HPI-II
Erechthites hieracifolia Linn.	Erechthites	Whole plant	HPI-VI
Eridictyon glutinosum Benth.	Eriodictyon glutinosum	Leaf	HPI-III
Erigeron canadensis Linn.	Erigeron canadense	Whole plant	HPI-IV
Erodium cicutarium (L.) L'Her.	Erodium cicuarium	Whole plant	HPI-VIII
Erythroxylum coca Lamarck.	Coca	Leaf	HPI-II

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Eschscholtzia californica Charm.	Eschscholtzia californica	Whole plant	HPI-VIII
Eucalyptus globulous Lobill., *E. fruticetorum, F. von* Mill., *E. Smithii* (R.T. Baker) Muell.	Eucalyptus oil, Nilgiri oil	Fresh leaves, fresh terminal branches	IP2014
Eucalyptus globulus Lab.	Eucalyptus globulus	Leaf	HPI-II
	Tailaparna	Leaf	API- V
Eupatorium ayapana Vent; *E. triplinerve* Vahl	Ayapana, Ayapan	Dried leaves	IP- 66
Eupatorium perfoliatum Linn.	Eupatorium perfoliatum	Leaf	HPI-I
Euphorbia cyparissias Linn.	Euphorbia cyparissias	Whole plant	HPI-VIII
Euphorbia dracunculoides(Lam)	Saptala	Whole plant	API- II
Euphorbia hirta L.	Brhatdugdhika	Whole plant	API- VI
Euphorbia prostrata W. Ait.	Doodhi khurd	Whole plant	UPI-V
Euphorbia royleana Bioss.	Zaqoom	Leaves	UPI-III
Euphorbia thymifolia L.	Dugdhika	Whole plant	API- V
Euphrasia officinalis Linn.	Euphrasia officinalis	Whole plant	HPI-I
Fabiana imbricata Ruiz. & Pav.	Fabiana imbricata	Leafy twig	HPI-IX
Fagonia cretica L.	Dhanvayasah	Whole plant	API- V
	Shukai	Whole plant	UPI-V
Fagopyrum esculentum Moench.	Fagopyrum esculentum	Whole plant	HPI-IV, VII
Ferula jaeschkeana Vatke	Hingupatri	Leaf	API- V
Filipendula ulmaria (L.) Maxim.	Filipendula ulmaria	Shoot with flower	HPI-VIII
Flacourtia indica Merr.	Sruvavrksa	Leaf	API- IV
Fucus vesiculosus Linn.	Fucus vesiculosus	Whole plant	HPI-III, IX
Fumaria parviflora Lam.	Parpata	Whole plant	API- IV
	Shahtara	Whole plant	UPI-VI
Galega officinalis Linn.	Galega officinalis	Whole plant	HPI-VIII
Galphimia glauca Cav.	Galphimia glauca	Dried Leaf and blossoms	HPI-IX

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Gaultheria procumbens Linn.	Gaultheria procumbans	Leaf	HPI-V
Genista tinctoria Linn.	Gentiana cruciata	Whole plant	HPI-V
Ginkgo biloba Linn.	Gingko biloba	Fresh leaf	HPI-VII
Gisekia pharnaceoides L.	Valuka saka	Leaf	API- VI
Glinus lotoides L.	Usandi	Whole plant	API- VI
	Ciruceruppataic camulam	Whole plant	SPI-II
Glycosmis pentaphylla (Retz.) Corroa.	Atista indica	Leaf	HPI-VII
Gnaphalium polycephalum Michx.	Gnaphalium polycephalum	Whole plant	HPI-IV
Gratiola officinalis Linn.	Gratiola officinalis	Whole plant	HPI-V
Grindelia comporum Green	Grindelia robusta	Leaf and flowering top	HPI-III, IX
Gymnema sylvestre R.Br. Syn. *Asclepias geminata* Roxb., *Periploca sylvestre* Retz	Gudmar, Gymnema sylvestre	Dried mature leaves	IP- 2014
	Mesasrngi	Leaf	API- V
	Gymnema sylvestris	Leaf	HPI-I
	Gurmar Buti	Leaf	UPI-II
Haplopappus baylahuen Remy.	Haplopappus baylahven	Leaf	HPI-VIII
Haronga madagascariensis Choisy	Harungana madagascariensis	Leaf and stem bark	HPI-VIII
Helianthemum canadense Mich.	Cistus canadensis	Whole plant	HPI-IV
Heliotropium indicum L.	Hastisundi	Dried areal part	API- VI
Heracleum sphondylim Linn.	Branca ursina	Whole plant	HPI-V
Herniaria glabra Linn.	Hernlniria glabra	Whole plant	HPI-VIII
Hippomane mancinella Linn.	Mancinella	Leaf, bark and fruit	HPI-V
Hordeum vulgare L.	Yava	Whole plant	API- IV
Hyoscyamus muticus L.; *H. niger* L.	Hyoscyamus	Dried leaves and flowing tops	IP- 66

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Hyoscyamus niger Linn.	Hyoscyamus niger	Whole plant (2nd year growth)	HPI-I
Hypericum perforatum Linn.	Hypericum perforatum	Whole plant	HPI-I, VIII
Ilex aquifolium Linn.	Ilex aquifolium	Leaf and fruit	HPI-VIII
Ilex paraguayensis St. Hilaire.	Ilex paraguayensis	Leaf	HPI-VII
Indigofera tinctoria L.	Nili	Leaf	API- II
	Nili	Whole plant	API- III
	Avuri	Whole plant	SPI-I
Jasminum officinale L.	Jati	Leaf	API- III
	Chanbeli	Leaf	UPI-IV
Juglans regia Linn.	Juglans regia	Leaf and green unripe fruit	HPI-IV
Juniperus sabina Linn.	Sabina	Stem and Leaf	HPI-I
Justicia adhatoda L.	Atatotai ilai	Leaf	SPI-I
Kalmia latifolia Linn.	Kalmia latifolia	Leaf	HPI-IV
Lachnanthes tinctoria Ell.	Lachinanthes tinctoria	Whole plant	HPI-IV
Lactuca virosa Linn.	Lactuca	Whole plant	HPI-VII
Lamium album Linn.	Lamium album	Leaf and flower	HPI-VII
Larrea mexicana Moric.	Larrea mexicana	Leaf and young branch	HPI-VIII
Lawsonia inermis L. Syn. *Lawsonia alba* Lam.	Madayanti	Leaf	API- IV
	Hina	Leaf	UPI-II
Ledum palustre Linn.	Ledum palustre	Whole plant	HPI-I
Lemna minor Linn.	Lemna minor	Whole plant	HPI-IV
Leonuorus cardiaca Linn.	Leonorus cardiaca	Whole plant	HPI-VIII
Lespedeza capitata Michx.	Lespedeza cafitata	Whole plant	HPI-IX
Lespedeza sieboldii Miq.	Lespedeza sieboldii	Aerial part	HPI-IX
Leucas aspera Sprang.	Leucas aspera	Whole plant	HPI-VI, VIII

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Leucas cephalotes Spreng.	Dronapuspi	Whole plant	API- II
Lillium tigrinum Ker-Gawl.	Lilium tigrinum	Whole plant	HPI-V, IX
Linaria vulgaris Mill.	Linaria vulgaris	Whole plant	HPI-VI
Lobaria pulmonaria (Linn.) Haffm.	Sticta pulmonaria	Whole plant	HPI-IV
Lobelia cardinalis Linn.	Lobelia cardinalis	Whole plant	HPI-V
Lobelia inflata Linn.	Lobelia inflata	Whole plant excluding root	HPI-II
Lobelia nicotianaefolia Heyne.	Lobelia	Dried aerial parts	IP- 66
Lobelia syphilitica Linn.	Lobelia syphilitica	Whole plant	HPI-VI
Loeselia coccinea G. Don	Hoitzia coccinea	Whole plant	HPI-VIII
Luffa acutangula (L.) Roxb.	Kosataki	Whole plant	API- III
Luffa echinata Roxb.	Luffa bindal	Whole plant with fruit	HPI-VI
Lycium barbarum L.	Kantakigulma	Aerial part	API- VI
Lycopersicum esculentum Milli.	Lycopersicum esculentum	Whole plant	HPI-V
Lycopus virginicus Linn.	Lycopus virgnicus	Whole plant	HPI-IV
Medicago sativa Linn.	Alfalfa	Whole plant excluding roots	HPI-II
Melia azedarach L.	Bakayin	Dried leaves	UPI-III
Mentha arvensis Linn.	Mentha arvensis	Leaf	HPI-IX
Mentha piperita Linn.	Mentha piperita	Whole plant, excluding root	HPI-II
Mentha spicata Linn.	Mentha viridis	Whole plant	HPI-IX
Mentha spp.	Mentha oil	Steam distillation of mentha	IP- 2014
Mentha viridis L.	Pudinah	Aerial part	API- V
	Nana pudina)	Aerial part	UPI-V
Menyanthes trifoliate Linn.	Menvanthes trifoliata	Whole plant	HPI-II, VIII
Mercurialis perennis Linn.	Mercurialis perennis	Whole plant	HPI-IV, VII

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Merremia tridentata (L.)Hall.f.	Matsyapatrika	Whole plant	API- VI
Mikania amara Willd.	Guaco	Leaf	HPI-VII
Mimosa pudica L.	Lajjalu	Whole plant	API- II
Mitchella repens Linn.	Mitchella repens	Whole plant	HPI-VI
Mollugo cerviana Seringe	Parpatakam	Whole plant	SPI-II
	Grismachatraka	Whole plant	API- VI
Moringa oleifera Lam.	Sehjana	Leaf	UPI-V
	Sigru	Leaf	API- II
	Moringa oleifera	Whole plant	HPI-IX
Murraya koenigii (L.) Spreng	Saurabhanimba	Leaf	API- VI
Myrrhis odorata (L.) Scop.	Myrrhis odorata	Whole plant excluding root	HPI-VIII
Myrtilocactus geometrizans Console	Myrtillocactus geometrizans	Shoot	HPI-VIII
Myrtus communis Linn.	Myrtus communis	Whole plant excluding root	HPI-IV, VII
Narcissus pseudo narcissus Linn.	Narcissus pseudo narcissus	Whole plant	HPI-VI
Nasturtium officinale R. Br.	Nasturtium officinale	Aerial part	HPI-VIII
Nepeta hindostana Roth.) Haines Syn. *N. ruderalis* Hook. f.	Badranjboya	Leaf	UPI-II
Nerium indicum Mill.	Karavira	Leaf	API- I
	Kaner	Dried leaves	UPI-I
Nerium oleander Linn.	Oleander	Leaf	HPI-III, VII
Nicotiana tabacum Linn.	Tabacum	Leaf	HPI-I
Nyctanthes arbortristis Linn.	Nyctanthes arbortristis	Leaf	HPI-III, VII
Ocimum basilicum L.	Basil oil (Methyl Chavicol Type), Tulsi ka tail	Steam distillation of part of plant (leaves & flowering tops)	IP- 2014
	Ocimum basilicum	Aerial part	HPI-IX

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Ocimum canum Sins.	Ocimum canum	Leaf	HPI-XI
Ocimum gratissimum Linn.	Ocimum gratissimum	Whole plant	HPI-VI
Ocimum sanctum L.	Tulasi	Leaf	API- II
	Rehan	Leaf	UPI-V
	Tulasi	Whole plant	API- II
	Rehan	Whole plant	UPI-V
	Tulasi Basil; Ocimum sanctum	Leaves	IP- 2014
	Ocimum sanctum	Whole plant excluding root	HPI-I
Ocimum tenuiflorum L.	Tulaci ilai	Leaf	SPI-II
Oldenlandia corymbusa Linn.	Oldenlandia herbacea	Whole plant	HPI-VII
Onosma bracteatum Wall.	Gojihva	Aerial part	API- III
	Goazaban	Dried Leaf	UPI-V
Opuntia vulgaris Mill.	Opunita	Whole plant excluding root	HPI-VI
Origanum vulgare Linn.	Origanum vulgare	Whole plant with flower	HPI-VII
Ornithogalum umbellatum Linn.	Ornithogalum umbellatum	Whole plant	HPI-IX
Oxalis acetosella Linn.	Oxalis acetosella	Aerial parts	HPI-VIII
Oxalis corniculata L.	Cangeri	Whole plant	API- III
	Puliyarai	Whole plant	SPI-II
Oxytropis lamberti Pursh.	Oxytropis	Whole plant excluding root	HPI-VI
Paederia foetida L.	Prasarini	Whole plant	API- II
Paris quadrifolia Linn.	Paris quadrifolia	Whole plant	HPI-IV
Paronychia illecebroides Webb.	Paronichia illecebrum	Whole plant	HPI-VIII
Parthenium hysterophorous Linn.	Parthenium	Whole plant	HPI-VII
Passiflora incarnata Linn.	Passiflora incanata	Leaf	HPI-II
Pavonia odorata Willd.	Gandhasipha	Whole plant	API- VI

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Pennisetum typhoides (Burm) Stapf & C.E. Hubb.	Vajranna	Leaf base	API- VI
Penthorum sedoides Linn.	Penthorum sedoides	Whole plant	HPI-VII
Pergularia daemia (Forsk) Chiov.	Visanika	Whole plant	API- VI
Petasites fragrans Presl.	Tussilago fragrans	Whole plant	HPI-VI
Petasites japonicus F. Schm.	Tussiilago petasites	Whole plant	HPI-V
Petasites officinalis Moench.	Petasites hybridus	Aerial part	HPI-VIII
Peteroselinum cripsum (Mill) Mym.	Petroselinum sativum	Whole plant	HPI-IV
Peumus boldus Molin.	Boldo	Leaf	HPI-VI
Phyla nodiflora (L.) Greene	Jalapippali	Whole plant	API- V
	Potutalai	Whole plant	SPI-I
Phyllanthus amarus Schum. & Thom.	Bhuiamla, Phyllanthus amarus	Dried aerial parts	IP- 2014
	Kilkkai nellic camulam	Whole plant	SPI-I
Phyllanthus fraternus Webst.	Tamalaki	Root Stem & Leaf	API- I
Pilocaprus jaborandi Holmes.	Jaborandi	Leaf	HPI-II
Pilocarpus microphyllus Stapf and other species of *Pilocarpus*	Pilocarpini nitras, pilocarpine nitrate	Leaves	IP- 55
Pinus sylvestris Linn.	Pinus sylvestris	Young shoot	HPI-V
Piper betle L.	Nagavalli	Leaf	API- III
	Verrilai	Leaf	SPI-II
	Tambol	Leaf	UPI-VI
Pistacia chinensis Burgo.	Karkatasrngi	Leaf	API- I
Pistia stratiotes L.	Jalakumbhi	Whole plant	API- VI
Plantago lanceolata L.	Vanya-asvagola	Leaf	API- VI
Plantago major Linn.	Plantago major	Whole plant	HPI-II
Plectranthus amboinicus (Lour.) spreng	Karpuravalli ilai	Leaf	SPI-II
Pluchea lanceolata (DC.) Oliv.& Hiern	Rasna	Leaf	API- III

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Polygonum punctatum Ell.	Polygonum punetatum	Whole plant	HPI-IV
Pongamia pinnata L. Pierre.	Karanj	Leaf	UPI-IV
	Karanja	Leaf	API- II
Portulaca oleracea L.	Kozuppa	Whole plant	API- II
	Khurfa	Whole plant	UPI-IV
Potentilla anserine Linn.	Potentilla anserine	Aerial part	HPI-VIII
Prenanthes serpentaria Pursh.	Nabalus serpentaria	Whole plant	HPI-VII
Prosopis cineraria Druce	Sami	Leaf	API- VI
	Vanni ilai	Leaf	SPI-II
Prunus laurocerasus Linn.	Laurocerasus	Leaf	HPI-IV, VIII
Prunus padus Linn.	Prunus padus	Leaf and bark	HPI-V
Pulsatilla nigricans Linn.	Pulsatilla nigricans	Whole plant	HPI-I
Punica granatum L.	Dadima	Leaf	API- IV
	Anar	Leaf	UPI-II
Ramunculus repens Linn.	Ranunculus repens	Whole plant	HPI-VIII
Ranunculos bulbosus Linn.	Ranunculus bulbosus	Whole plant	HPI-IV, VIII
Ranunculus acris Linn.	Ranunculus acris	Whole plant	HPI-V
Ranunculus sceleratus Linn.	Ranunculus scleratus	Whole plant excluding root	HPI-IV
Raphanus sativus L.	Mulaka	Whole plant	API- II
Rhododendron chrysanthum Pall.	Rhododendron chrysanthum	Leaf and flower bud	HPI-II
Rhus parviflora Roxb.	Tintidika	Aerial part	API- V
Rhus toxicodendron Mich.	Rhus toxicodendron	Leaf	HPI-I, IX
Rhus venenata DC.	Rhus venenata	Stem and leaf	HPI-II
Ricinus communis L.	Eranda	Fresh leaf	API- III
Rumex acetosa Linn.	Rumex acetosa	Leaf	HPI-VIII
Ruta graveolens L.	Barg-e-Sudab	Leaf	UPI-VI
	Ruta graveolens	Whole plant	HPI-I
Salix alba L.	Sveta Vetasa	Leaf	API- VI

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Salvadora persica L.	Pilu	Leaf	API- V
	Pilu	Leaf	UPI-V
Salvia officinalis Linn.	Salvia officinalis	Leaf and flower	HPI-VI
Sambucus nigra Linn.	Sambucus nigra	Leaf and flower	HPI-II
Santolina chamaecyparissus Linn.	Santolina chamaecyparissus	Whole plant	HPI-IX
Sarracenia purpurea Linn.	Sarracenia purpurea	Whole plant	HPI-IV
Scrophularia nodosa Linn.	Scrophularia nodosa	Whole plant	HPI-VI
Scutellaraia lateriflora Linn.	Scutellaria	Whole plant excluding root	HPI-III
Sedum acre Linn.	Sedum acre	Whole plant	HPI-VI
Sempervivum tectorum Linn.	Sempervivum tectorum	Leaf	HPI-VI
Senecio aureus Linn.	Senecio aureus	Whole plant	HPI-II
Senecio cineraria DC.	Cineraria maritima	Whole plant	HPI-V
Sesbania sesban (L.) Merr.	Jayanti	Leaf	API- II
	Karuncempai ilai	Leaf	SPI-I
Siegesbeckia orientalis Linn.	Siegesbeckia orientalis	Whole plant	HPI-IX
Silphium laciniatum Linn.	Silphinum laciniatum	Whole plant	HPI-VI
Solanum anguivi Lam.	Brhati	Whole plant	API- VI
Solanum carolinense Linn.	Solanum carolinense	Whole plant	HPI-V
Solanum dulcamara Linn.	Dulcamara	Whole plant	HPI-I
Solanum nigrum L.	Kakamaci	Whole plant	API- II
	Mako	Whole plant	UPI-IV
	Solanum nigrum	Whole plant with fruit including root	HPI-II
Solanum surattense Burm.f. Syn. *Solanum xanthocarpum* Schrad. & Wendl.	Kantakari	Whole plant	API- I
	Kantan kattiric camulam	Whole plant	SPI-I
	Katai	Shoot	UPI-II
	Solanum xanthocarpum	Whole plant	HPI-VI

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Sphaeranthus indicus L.	Munditika	Leaf	API- III
	Munditika	Whole plant	API- IV
Spigelia marllandica Linn.	Sparteinum sulphuricum	Whole plant	HPI-VI
Stachys officinalis Franch.	Stachys officinalis	Whole plant excluding root	HPI-VIII
Stellaria media (Linn.) Vill.	Stellaria media	Whole plant	HPI-IX
Swertia chirata Buch. Ham.	Chiraita	Dried whole plant	UPI-I
	Kiratatikta	Whole plant	API- I
	Swertia chirata	Whole plant excluding root	HPI-VI, VIII
Tancetum vulgare Linn.	Tanacetum vulgare	Leaf and flowering twig	HPI-V
Taraxacum officinale Weber	Taraxacum	Whole plant	HPI-III
Taxus baccata L.	Sthauneya	Leaf	API- III
Taxus wallichiana Zucc.	Talicap pattiri	Leaf	SPI-II
Teramnus labialis Spreng.	Masaparni	Whole plant	API- III
Teucrium marum Linn.	Teucrum marum verum	Whole plant	HPI-IV
Teucrium scorodonia Linn.	Teucrium scorodonia	Aerial part	HPI-VIII
Thuja occidentalis Linn.	Thuja occidentalis	Leaf and twig	HPI-I
Thymus serphyllum Linn.	Thymus serpyllum	Whole plant	HPI-VII
Thymus vulgaris Linn.	Thymus vulgaris	Whole plant	HPI-VIII
Toddalia asiatica (L.) Lam.	Katugulma	Whole plant	API- VI
Tragia involucrata L.	Vrscikalli	Whole plant	API- IV
Trianthema decandra L.	Laghupatra-Varsabhu	Whole plant	API- VI
Trianthema portulacastrum L.	Penarnava, Penarnaba	Leaves, fresh dried plant	IPL
Tribulus terrertris L.	Neruncil camulam	Whole plant	SPI-II
	Goksura	Whole plant	API- VI
	Tribulus terrestris	Whole plant	HPI-I

Botanical Name (as specified in Pharmacopoeial Monograph)	Pharmacopoeial Title	Morphological Part specified as drug	Reference
Turnera diffusa Willd var. *aphrodisiaca* Vrb.	Damiana	Whole plant	HPI-V & VII
Tussilago farfara Linn.	Tussilago farfara	Whole plant	HPI-IV
Tylophora indica Burn. (Merill)	Tylophora indica	Leaf	HPI-VI
Uraria picta Desv.	Prsniparni	Whole plant	API- IV
Urticaurens Linn.	Urtica urens	Whole plant	HPI-IV
Usnea barbata Heffm.	Usnea barbata	Whole plant	HPI-V
Verbascum thapsus Linn.	Verbascum thaspus	Whole plant	HPI-II
Verbena officinalis Linn.	Verbena officinalis	Whole plant	HPI-VI
Vernonia cinerea Lees.	Sahadevi	Whole plant	API- III
Vigna trilobata (L.) Verdc.	Mudgaparni	Whole plant	API- IV
Vinca minor Linn.	Vinca minor	Whole plant	HPI-IV
Vincetoxicum hirudinaria Medic.	Vincetoxicum hirudinaria	Leaf	HPI-VIII
Viola odorata Linn.	Viola odroata	Whole plant	HPI-IV
Viola pilosa Blume.	Banafsha	Dried leaves	UPI-III
	Banafsha	Dried whole plant	UPI-III
Viola tricolor Linn.	Viola tricolor	Whole plant	HPI-IV
Viscum album Linn.	Viscus album	Leaf and fruit	HPI-II
Vitex negundo L.	Sambhalu	Dried leaf	UPI-V
	Nirgundi	Leaf	API- III
	Nocci ilai	Leaf	SPI-II
Wedelia calendulacea Lees.	Kesaraja	Whole plant	API- VI
Wedelia chinensis Merril	Porralai kaiyantakarai	Aerial parts	SPI-II
Xanthium spinosum Linn.	Xanthium sfinosum	Whole plant	HPI-IX
Yucca filamentosa Linn.	Yucea filamentosa	Root, leaf and flower	HPI-V

2. **Monographic Review –** The Indian work pertinent to pharmacognostical characteristics of leaf drugs published in the form of books, monographs etc. are enumerated in Table-2.

Table 2: Pharmacognostic work on leaf drugs in Indian monographic and book references

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Abelmoschus moschatus Medic.	Mushkdana	Leaf	SSDUM-V
Abies spectabilis(D. Don) Mirb. syn.*A. webbiana*Lindl.	Talisapatra	Leaf	MPLD-II
	Talisa	Leaf	QSIMP-VIII
Abrus precatorius Linn.	Gunja	Leaf	MPLD-II
Acacia nilotica (Linn.) Del.	Babool	Leaf	SSDUM-IV
Acacia pennata(Linn.) Willd. syn.*Mimosa pennata*Linn.	Adari	Leaf	QSIMP-XI
Acalypha indica Linn.	Dadaro	Leaf	PILD
	Haritamanjari	Whole plant	QSIMP-XII
*Acanthus ilicifolius*Linn.	Attumulli (Tamil)	Leaf	QSIMP-VI
Achillea millefolium Linn.	Biranjasifa	Leaf	MPLD-II
	Biravijasipha	Aerial parts	QSIMP-V
*Achyranthes aspera*Linn. syn.*A. canescens*R. Br.; *A. argentea*Decne;*A. grandifolia*Moq.;*A. obovata*Peter.;*A. repens*Linn.	Khar-e-vasgona	Stem, Leaf	SSDUM-IV
	Apamarga	Whole Plant	PAD-VI
	Apamarga	Whole plant	QSIMP-IX
	Apang	Whole Plant	IHP
*Achyranthes bidentata*Blume	Ceauradanada Apamarga	Whole plant	QSIMP-XI
Acronychia pedunculata (Linn.) Miq.	Ankenda	Leaf	MPLD-II
Adhatoda beddomei C.B. Clarke	Vasa	Stem, Leaf	PID-II
	Vasa	Leaf	QSIMP- III
Adhatoda vasica Nees	Aroosa	Leaf	SSDUM-IV
	Vasaka	Leaf	PILD
*Adhatoda zeylanica*Medik. syn.*A. vasica*Nees;*Justicia adhatoda*Linn.	Vasa	Stem, Leaf	PID-II
	Arusa	Leaves	IHP
	Vasa	Leaf	MPLD-II
	Vasa	Leaf	QSIMP-XI
Adiantum capillus-veneris Linn.	Parsiaoshan	Leaf	SSDUM-II
*Adiantum lunulatum*Burm. f. syn. *A. philippense*Linn.	Hamsapadi	Whole plant	QSIMP-XIV
*Adiantumcapillus-veneris*Linn.	Bijapatra	Whole plant	QSIMP-XII
Aegle marmelos (L.) Corr.	Bel	Root, Stem, Leaf, Fruit, Seed	MPWG
	Barg-e-Bel	Leaf	SSDUM-II
Aerrva lanata Linn.	Goraksaganja	Leaf	MPLD-II
	Bhadra	Whole Plant	PAD-VI
	Pasanabheda	Whole plant	QSIMP- III
*Agave americana*Linn.	Banskeora (Hin)	Leaf	QSIMP-V

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Ailanthus excelsa Roxb.	Araluka	Bark, Leaf	PID-I
	Aralu	Leaf	MPLD-II
Alangium salvifolium(Linn. f.) Wang. var. *salvifolium*syn.*A. lamarckii*Thw.	Ankot	Stem bark & Leaf	PAD-XI
	Vanirota	Leaf	QSIMP-V
Alhagi pseudalhagi(M. Bieb.) Desv. syn. *A. camelorum*Fisch. ex DC.;*A. maurorum* sensuBaker, non Desv.	Jawansa	Stem, Leaf	SSDUM-V
	Yavasa	Whole plant	QSIMP-VII
Allium cepa Linn.	Onion	Leaf	PILD
Allium sativum Linn.	Lahsan/Garlic	Leaf	PILD
Aloe vera(Linn.) Burm. f. syn.*A. barbadensis*Mill.; *A. perfoliata*Linn.	Ghikanwar	Juice of Leaves	IHP
	Sibr	Dried leaves	SSDUM-II
	Barg-e-Gheekwar	Leaf	SSDUM-II
	Kumara	Leaf, Fresh gel, Dried juice	QSIMP-IX
Alternanthera sessilis(Linn.) R.Br. ex DC. syn. *A. nodiflora*R. Br.	Matsyaksi	Whole plant	QSIMP-V
*Amaranthustricolor*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
*Ammannia baccifera*Linn. syn.*A. salicifolia*sensu Clarke	Dadmari	Leaf	QSIMP-VIII
Andrographis paniculata(Burm. f.) Wall. ex Nees syn.*A. subspathulata*C.B. Clarke;*Justicia paniculata*Burm. f.	Mahatita	Arial Part	IHP
	Kalmegh	Arial Parts, Leaf	QASIMP
	Kalmegh	Arial Parts, Leaf	QASIMP
	Kalmegh	Leaf	PILD
	Coraka	Aerial parts	QSIMP-VIII
Anisomeles malabarica(Linn.) R.Br. ex Sims	Sprkka	Aerial parts	QSIMP-VI
Anogeissus latifolia Wall.	Dhava	Stem, Leaf	PID-I
*Apium graveolens*Linn.	Kharaphsa	Whole plant	QSIMP-XIII
*Argemonemexicana*Linn.	Swarnashiri	Root, Stem & Leaf	PAD-XI
	Svarnaksiri	Whole plant	QSIMP-XII

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Argyreia nervosa(Burm. f.) Bojer syn.*A. speciosa*(Linn. f.) Sweet	Vriddhadaruka	Root, Stem, Leaf	PID-II
	Vrddhadaruka	Leaf	QSIMP-V
	Vrddhadaru	Leaf	MPLD-II
*Aristolochia bracteolata*Lamk. syn.*A. bracteata*Retz.	Kitamari	Leaf	QSIMP-V
*Aristolochia indica*Linn.	Isvari	Leaf	QSIMP-XIV
Artemisia absinthium Linn.	Barg-e-Afsanteen	Leaf	SSDUM-II
*Artemisia annua*Linn.	Quinghaq (Chinese)	Whole plant	QSIMP- I
Artemisia vulgaris Linn.	Biranjasif	Stem, Leaf, Flower	SSDUM-II
Asclepias curassavica Linn.	Kakatundi	Leaf	PID-I
	Kakanasa	Whole plant	QSIMP-VII
Atropa acuminata Royle ex Lindl.	Suci	Leaf	MPLD-II
	Indian Belladonna	Leaf	PILD
*Atropa belladonna*Linn.	Suci	Leaf	QSIMP-XIII
*Azadirachta indica*A. Juss. syn.*Melia azadirachta*Linn.	Barg-e-Neem	Leaf	SSDUM-II
	Nimba	Leaf	MPLD-II
	Neem	Leaf	PILD
		Leaf	QSIMP-XI
Bacopa monnieri(Linn.) Pennell syn.*Herpestis monnieria*(Linn.) H.B. &K.; *Lysimachia monnieri*Linn.	Herpestis	Leaf	PILD
	Brahmi	Stem, Root, Leaf	MPWG
	Brahmi	Whole Plant	QASIMP
	Brahmi	Stem, Root, Leaf	PAD-XII
	Brahmi	Whole Plant	IHP
	Brahmi	Leaf	MPLD-II
	Priyala	Whole plant	QSIMP-VIII
Baliospermum montanum(Willd.) Muell. -Arg. syn. *Jatropha montana*Willd.; *Baliospermum axillare*Blume	Danti	Stem, Root, Leaf	MPWG
	Danti	Stem, Leaf, Root-Stock	PID-I
	Danti	Leaf	QSIMP-XIII
Bambusa bambos(Linn.) Voss syn.*B. arundinacea*(Retz.) Willd.;*B. orientalis*Nees	Vamsa	Tender shoot	QSIMP-XIII
*Barleria prionitis*Linn.	Sairayak	Whole plant	QSIMP-IV
Barringtonia acutangula Gaertn.	Nicula	Leaf, Bark, Fruit, Root	PID-III
Barringtonia recemosa (Linn.) Roxb.	Samudraphala	Leaf, Bark, Friut	PID-III
*Basella alba*Linn. var. *alba*syn.*B. rubra*sensu Hook. f., p.p.	Upodika	Leaf	QSIMP-V

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
*Bauhinia vahlii*Wight & Arn. syn.*Phanera vahlii* (Wight & Arn.) Benth.	-	Fresh & Dried Leaf	QSIMP-XIII
Beta vulgaris Linn. var. cicla Moq.	Palankya	Leaf	PID-II
Biophytum reinwardtii Edgw. & Hk. f.	Lajjalu	Whole Plant	PAD-VI
Biophytum sensitivum DC.	Lajjalu	Whole Plant	PAD-VI
Blumea lacera(Burm. f.) DC. syn.*B. subcapitata*DC.	Kukundara	Root, Stem, Leaf, Flower	PID-III
	Kumundara	Whole plant	QSIMP-VI
*Boerhavia diffusa*Linn. syn.*B. repens*Linn. var. *procumbens*Hook. f.;*B. procumbens*Banks ex Roxb.	Punarnava	Leaf	PILD
	Gadapurna	Whole Plant	IHP
	Punarnava	Whole plant	QSIMP-IX
Borago officinalis Linn.	Gaozaban	Leaf	SSDUM-I
Borrerio hispida (Linn.) K. Schum	Vasuka	Root, Stem Leaf	PAD-XII
Calotropis gigantea (Linn.) R. Br.	Arka	Root, Leaf	PID-I
	Alarka	Leaf	MPLD-II
Calotropis procera(Ait.) Ait. f. ssp.*hamiltonii*(Wight) Ali syn.*C. procera*auct. non (Ait.) Ait. f.	Barg-e-Madar	Leaf	SSDUM-II
	Arka	Leaf	MPLD-II
	Arka	Root, Leaf	PID-I
	Arka	Leaf, Flower	QSIMP-V
Camellia sinensis (Linn.) Kuntze	Tea	Leaf	PILD
	Thea Chinensis	Leaf	SHD-I
	Chaha	Leaf	MPLD-II
Cannabis sativa Linn.	Qinnab	Leaf	SSDUM-IV
	Bhang	Leaf	PILD
	Bhanga	Leaf	MPLD-II
	Bhanga	Leaf	QSIMP-IV
Capparis sepiaria Linn.	Himsra	Leaf, Stem, Root	PID-III
Capparis zeylanica Linn.	Vyagranakhee	Root, Stem	PID-II
Cardiospermum halicacabum L.	Cardiospermum Halicacabum	Leaf, Stem	SHD-IV
	Indravalli	Whole Plant	PAD-VI
	Kakadani	Whole plant	QSIMP-VI
	Karnasphota	Leaf	MPLD-II
*Carthamus tinctorius*Linn.	Kusumbha	Leaf	QSIMP-XI
Cassia angustifolia Vahl.	Swarnapatr1	Leaf	MPLD-II
	Sana	Leaf	SSDUM-V
	Senna	Leaf	PILD
Cassia fistula Linn.	Barg-e-Amaltas	Leaf	SSDUM-II
	Aragvadha	Root, Stem, Leaf, Fruit	PID-I

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Cassia obtusifolia Linn.	Chakramarda	Root, Stem, Leaf	PID-I
Cassia occidentalis Linn.	Kasamarda	Leaf	MPLD-II
	Kasamarda	Root, Stem Leaf	PID-I
	Kasamarda	Leaflet, Seed	QSIMP- I
*Cassia senna*Linn. var. *senna*syn.*C. angustifolia*Vahl	Swarna-Patri	Leaf	PID-III
	Svarnpatri	Leaflet, Pod	QSIMP- I
Cassia sophera Linn.	Kasamardabhed	Leaf	MPLD-II
Cassia tora Linn.	Chakramarda	Leaf	MPLD-II
Catharanthus roseus(Linn.) G.Don syn.*Vinca rosea*Linn.;*Lochnera rosea*(Linn.) Reichb.	Sadapuspa	Leaf	MPLD-II
	Sadapuspi	Leaf	QSIMP- II
Celastrus paniculatus Willd.	Malkangani	Stem, Root, Leaf, Seed	MPWG
Centella asiatica(Linn.) Urban syn.*C. coriacea*Nannf.;*Hydrocotyle asiatica*Linn.; *H. lanata*Linn.; *H. wightiana*Willd.	Brahmi	Leaf	PILD
	Mandukaparni	Leaf	MPLD-II
	Aranyayiraka	Whole plant	QSIMP-VIII
	Brahma- Manduki	Arial Part	IHP
Cephalandra indica Cong.	Cephalandra Indica	Leaf	SHD-IV
*Chenopodium ambrosioides*Linn.	Sugandha vastuka	Whole plant	QSIMP-X
*Chrysanthemum indicum*Linn.	Guladaudi	Leaf	QSIMP-XI
Cicer arietinum Linn.	Chanaka	Leaf, Fruit, Seed	PID-I
Cichorium intybus Linn.	Barg-e-Kasni	Leaf	SSDUM-II
	Kasani	Leaf	QSIMP-XIII
Cinnamomum camphora (Linn.) Sieb.	Karpura	Leaf	MPLD-II
	Karpura	Leaf, Stem bark	QSIMP- III
Cinnamomum malabatrum Reinw.	Tamal patra bhed (III)	Leaf	MPLD-II
Cinnamomum sulphuratum Necs.	Tamal patra bhed (II)	Leaf	MPLD-II
Cinnamomum tamala(Buch.-Ham.) Nees & Eberm.	Tamalpatra	Leaf	MPLD-II
	Tejpat	Leaf	PILD
	Tamalapatra	Leaf	QSIMP- III
Cinnamomum zeylanicum Breyn.	Tamal patra bhed (I)	Leaf	MPLD-II
Citrullus colocynthis(Linn.) Schrad. syn.*Cucumis colocynthis*Linn.	Indra varuni	Leaf	QSIMP-XI
Clerodendron infortunatum Linn.	Bhant	Leaf	PILD
	Langhu Agnimantha	Leaf	QSIMP-XII
*Clitoria ternatea*Linn.	Aparajta	Leaf	QSIMP-IV
	Aparajita	Leaf	MPLD-II

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Coccinia grandis(Linn.) Voigt. syn.*Cephalandra indica*Naud;*Coccinia indica* Wight & Arn.;*C. cordifolia*(Linn.) Cogn.	Bimbi	Aerial parts	QSIMP-V
	Bimbi	Root & Leaf	PAD-XI
Coldenia procumbens Linn.	Tripakshi	Leaf	MPLD-II
*Colebrookea oppositifolia*Smith	Pansra (Hin, Beg.)	Leaf	QSIMP-V
Commiphora wightii (Arnott) Bhand.	Guggulu	Stem, Leaf	PID-I
*Convolvulus microphyllus*Sieb. ex Spreng. syn.*C. pluricaulis*Choisy	Sankhapuspi	Leaf	MPLD-II
	Sankhapuspi	Whole plant	QSIMP- II
Cordia dichotama Forst.f.	Sapistan	Leaf	SSDUM-II
Coriandrum sativum Linn.	Kishneez Sabz	Leaf	SSDUM-III
Coscinium fenestratum (Gaertn.) Colebr.	Jhar-I- Haldi	Root, Leaf	MPWG
Costus pictus D. Don.	insulin plant	Leaf	MPLD-II
Crateva magna (Lour.) DC.	Barun	Root, Leaf	MPWG
Crateva nurvala Buch. Ham.	Varun	Root, Stem, Leaf	PID-II
*Cuscuta reflexa*Roxb.	Akasarvalli	Whole plant	QSIMP-V
Cymbopogon citratus(DC.) Stapf. syn.*Andropogon citratus*DC.	Lemon grass	Leaf	PILD
	Bhustrina	Leaf	MPLD-II
	Kattrna	Leaf	QSIMP-X
Cymbopogon Jwarancusa Jones Schultz	Izkhar	Root, Stem and leaf	SSDUM-III
Cymbopogon martini(Roxb.) W. Wats.	Rohisa	Whole plant	QSIMP-XIII
Cymbopogon nardus Rendle.	Citranellh	Leaf	PILD
Cynodon dactylon(Linn.) Pers.	Durva	Whole Plant	PAD-VI
	Amalaki	Whole plant	QSIMP-VIII
Datura fastuosa Linn.	Black Datura	Leaf	PILD
	Krishnadatura	Leaf	MPLD-II
	Dhattorah	Root, Leaf	PAD-X
Datura innoxia Linn.	Swetadatura	Leaf	MPLD-II
*Datura metel*Linn. syn.*D. fastuosa*Linn.	Datura	Leaf	PILD
	Dustura	Leaf	MPLD-II
	Dhattura	Seed, Leaf	QSIMP-VI
*Datura stramonium*Linn.	Thorn Apple	Leaf	PILD
	Kanaka	Leaf	MPLD-II
	Dhatura	Leaves	IHP
	Dhatura	Leaf, Seed	QSIMP-X
Delonix elata Gamble.	Sandesaro	Leaf	MPLD-II
Derrisindica(Lamk.) Bennet syn.*Pongamia glabra*Vent.;*P. pinnata*(Linn.) Pierre	Karanja	Leaflet	QSIMP-XII

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Desmodiumgangeticum(Linn.) DC. syn.*D. gangeticum*(Linn.) DC. var. *maculatum*(Linn.) Baker	Salaparni	Aerial parts	QSIMP-XII
*Didymocarpus pedicellatus*R. Br. (*pedicellata*)	Silapuspa	Whole plant	QSIMP-V
*Digitalis lanata*Ehrh.	Hritpatri	Leaf	MPLD-II
	Hritpatri	Leaf	QSIMP- II
*Digitalis purpurea*Linn.	Hritpatri	Leaf	PID-III
	Foxglove	Leaf	PILD
	Foxglove	Leaf	MPLD-II
	Hrtpatu	Leaf	QSIMP-VI
Eclipta alba (Linn.) Hassk	Bhangra	Stem & Leaf	SSDUM-III
	Bhringaraja	Leaf	MPLD-II
Eclipta prostrata(Linn.) Linn. syn.*Verbesina prostrata*Linn.;*E. alba*(Linn.) Hassk.;*E. erecta*Linn.	Bhangra	Whole Plant	IHP
	Bhrngaraja	Whole plant	QSIMP-IX
Elephantopus scaber Linn.	Gujihava	Root, Leaf	PAD-XII
Embelia ribes Burm. f.	Vaividang	Stem, Root, Leaf, Fruit	MPWG
Emblica officinalis Gaertn.	Aamla	Leaf	SSDUM-V
Emilia sonchifolia DC.	Sasasruti	Whole Plant	PAD-VI
Enicostemma hyssopifolium(Willd.) Verd. syn.*E. littorale*Blume	Mamjjaka	Whole plant (Root and vegetative part)	QSIMP- III
*Eupatorium triplinerve*Vahl syn.*E. ayapana*Vent.	Varahikanda	Whole plant	QSIMP-XI
*Euphorbia hirta*Linn. syn.*E. piluliferaa*uct. non Linn.	Dudhi	Whole plant	SSDUM-I
	Brhat Dugdhika	Whole plant	QSIMP-X
*Euphorbia prostrata*W. Ait.	Dugdhika bheda	Whole plant	QSIMP- II
*Euphorbia thymifolia*Linn.	Dudhi khurd	Whole plant	SSDUM-I
	Dugdhika	Whole plant	QSIMP- III
Evolvulus alsinoides(Linn.) Linn.	Visnukranta	Aerial parts	QSIMP-IV
*Exacum tetragonum*Roxb. syn.*E. bicolor*Roxb.	Avartani	Whole plant	QSIMP-VIII
*Fagonia indica*Burm. f.syn.*F. creticaa*uct. non Linn.;*F. arabica*auct. non Linn.	Duralabha	Whole plant	QSIMP-IX
Ficus amplissima Sm.	Plaksha	Stem, Leaf	PID-II
*Ficus benghalensis*Linn.	Nyagrodha jaya	Aerial Root	QSIMP-XIII
*Frerea indica*Dalzell	Milkweed	Whole Plant	PNLP
Fumaria indica(Haussk.) Pugsley syn.*F. parviflora*auct. non. Lam.;*F. vaillantii* (Loisel.) Hook. f. & Thoms.	Snuhi	Whole plant	QSIMP-XI

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
*Getoniafloribunda*Roxb. syn.*Calycopteris floribunda*(Roxb.) Lamk. ex Poir.	Pullani	Leaf	QSIMP-XII
Ginkgo biloba Linn.	Ginkgo	Leaf	MPLD-II
*Ginkgo biloba*Linn.	Ginkgo	Leaf	QSIMP-XIV
Gmelina asiatica Linn.	Kasmari		PAD-II
*Heliotropiumindicum*Linn.	Hastisundi	Whole plant	QSIMP-XII
Hemidesmus indicus (Linn.) R.Br.	Anantamul	Stem, Root, Leaf	MPWG
	Anantamul	Leaf	PID-I
Hibiscus rosa-sinensis Linn.	Japa	Root, Stem, Leaf	PID-I
Holarrhena pubescens (Buch.Ham.) Wall.ex Don	Kurchi	Stem, Bark, Root, Leaf	MPWG
Holostemma ada-kodien Schult.	Chirvel	Stem, Root, Leaf	MPWG
Hygrophila auriculata(K. Schum.) Heine syn. *Asteracantha longifolia*(Linn.) Nees; *Hygrophila spinosa*T. Anders.;*Barleria auriculata*K. Schum.	Kokilaksa	Whole plant	QSIMP-IX
Hygrophila spinose (Schum.) Hiene	Hygrophila Spinose	Leaf, Stem, Root	SHD-IV
Hyoscyamus muticus Linn.	Indian Henabane	Leaf	PILD
Hyoscyamus niger Linn.	Henbane	Leaf	PILD
	Parsikayavani	Leaf	MPLD-II
Hypericum perforatum Linn	Hypericum Perforatum	Leaf, Stem	SHD-III
	Bassant	Aerial parts	QSIMP- II
Indigofera tinctoria Linn.	Neeli	Leaf	MPLD-II
	Nili	Leaf	QSIMP-XIV
Ipomoea pescaprae Linn. Sw.	Vriddhadaruka	Root, Stem, Leaf	PID-II
Ipomoea petaloidea Chois.	Vriddhadaruka	Root, Stem, Leaf	PID-II
Jasmimum grandiflorum Linn.	Chameli	Leaf	SSDUM-IV
Jasminum auriculatum Vahl.	Jutika	Leaf	MPLD-II
	Yuthika	Leaf, Flower	QSIMP-VI
*Jasminum grandiflorum*Linn. syn.*J. officinale*Linn. forma*grandiflorum*(Linn.) Kobuski	Jati	Leaf	MPLD-II
	Jati	Leaf	QSIMP-VII
Jatropha curcas Linn.	Dravanti	Root, Stem, Leaf	PID-I

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Juglans regia Linn.	Juglans Regia	Leaf, Fruit, Seed	SHD-IV
Juncus effusus Linn.	Juncus Effusus	Stem, Leaf, Root	SHD-I
Justicia gendarussa Burm.	Nila-Nirgundi	Stem, Leaf	PID-II
Kaempferia rotunda Linn.	Bhuyi champa	Rhizome, Root, Leaf	MPWG
Kalanchoe pinnata Pers.	Parnabija	Leaf	MPLD-II
Lactuca sativa Linn.	Kahu	Leaf	SSDUM-V
*Lawsonia inermis*Linn. syn.*L. alba*Lamk.	Lawsonia Inermis	Leaf	SHD-II
	Hina	Leaves	SSDUM-I
	Madyantika	Leaf	QSIMP- I
	Madayanti	Leaf	PID-II
	Madayantika	Leaf	MPLD-II
	Henna	Leaf	PILD
Leptadenia reticulata (Retz.) Wight & Am.	J1vanti	Leaf	MPLD-II
	Jivanti	Leaf, Stem	QSIMP- III
Leucas cephalotes(Roth) Spreng.	Dronapuspi	Whole plant	QSIMP- II
Leucas plukenetii(Roth) Spreng. syn.*L. aspera*(Willd.) Link	Chhata Heekusa(Beng&hin)	Aerial parts	QSIMP-V
Limonia acidissima Linn.	Katbel	Stem, Root, Fruit, Seed, Leaf	MPWG
Lippia nodiflora Rich.	Bukun Buti	Whole plant	SSDUM-IV
Lobelia nicotianaefolia Linn.	Nala	Leaf	MPLD-II
Lochnera rosea (L.) Reichb Linn.	Sadompushpa	Stem, Root, Leaf	PAD-XII
Luffa acutangula(Linn.) Roxb. syn.*Cucumis acutangulus*Linn.	Kosataki	Whole plant	QSIMP-IX
Majorana hortensis Moench	Origanum Majiorana	Leaf, Stem	SHD-III
Marsilea minuta Linn.	Sunisannaka	Leaf, Sporocarp	PID-III
Medicago sativa Linn	Alfalfa	Leaf, Stem, Flower	SHD-I
Melia azedarach Linn. (=*M. sempervirens* Sw.)	Bakayin	Leaf	SSDUM-V
	Mahanimba	Leaf	MPLD-II
	Mahanim	Leaf	PILD
Melissa officinalis Linn.	Badaranja boya	Leaf	MPLD-II
Mentha arvensis Linn.	Pudinah	Leaf	PILD
	Podina	Leaf, stem	SSDUM-III
*Mentha piperita*Linn.syn.*M. nigricans*Mill.	Pippermint	Leaf	PILD
	Pepermint	Leaf	MPLD-II
		Leaf	QSIMP-IX

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
*Mentha spicata*Linn. syn.*M. viridis*Linn.	Pudina	Leaf	MPLD-II
	Putiha	Leaf	QSIMP-IX
Mentha x piperita Linn.	Pudina	Leaves	IHP
Merremiatridentata(Linn.) Hall. f. syn.*Ipomoea tridentata*(Linn.) Roth	Matsyapatrika	Whole plant	QSIMP-XII
*Mimosa pudica*Linn.	Lajjalu	Stem, Root & Leaf	PAD-XI
	Lajjalu	Whole Plant	PAD-VI
	Samanga	Leaf	QSIMP-IX
Mimusops elengi Linn.	Bakula	Stem, Leaf, Fruit, Seed	PID-I
Momordica charantia Linn.	Karela	Leaf	PILD
Morinda tinctoria Roxb.	Achchhuka	Leaf	MPLD-II
Moringa concanensis Nimoo.	Madhushigru	Leaf	MPLD-II
*Moringa oleifera*Lamk. syn.*M. pterygosperma*Gaertn.	Sigru	Leaf	MPLD-II
	Sigru	Leaf	QSIMP-X
Murraya koenigii(Linn.) Spreng.	Kaidarya- nimba	Leaf	MPLD-II
	Kaidarya	Root, Stem Bark, Root, Leaf	PID-I
	Kaidarya	Root Bark, Stem Bark, Leaf rachis	PAD-III
	Kaidaranimba	Leaflet	QSIMP- I
Murraya paniculata (L.) Jack	Kaidarya	Root, Stem Bark, Root, Leaf	PID-I
Myxopyrum-smilacifolium Blume.	Heimamalati	Leaf	MPLD-II
Nelumbo nucifera Gaertn.	Pundarika	Rhizome, Leaf	PID-II
Nepeta hindostana (Roth.) Haines	Badranjboya	Leaf	SSDUM-V
*Nerium indicum*Mill. syn.*N. odorum*Soland.	Karavira	Root, Stem, Leaf	PID-I
	Atnagupta	Leaf	QSIMP-XI
	Karavira	Leaf	MPLD-II
Nervilia aragoana Gaud.	Sthalapadma	Corm, Leaf	MPWG
Nicotiana tabacum Linn.	Tobacco	Leaf	PILD
Nyctanthus arbor-tritis Linn.	Harsingar	Leaf	PILD
	Parijata	Leaf	QSIMP- III
	Parijata	Leaf	MPLD-II
Ocimum americanum Linn.	Ocimum Canum	Leaf	SHD-II
	Arjaka	Leaf	MPLD-II
*Ocimum basilicum*Linn.	Barbari	Leaf	MPLD-II
	Barbari	Leaf	QSIMP- II
*Ocimum gratissimum*Linn.	Vrdhatulasi	Leaf	MPLD-II
	Vrdhatulau	Leaf	QSIMP- II

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
*Ocimum kilimandscharicum*Guerke	Karpurtihsi	Whole plant	QSIMP-IX
	Karpura tulas1	Leaf	MPLD-II
Ocimum sanctum Linn.	Sacred basil	Leaf	PILD
	Tulasi	Leaf	MPLD-II
	Tulasi	Leaf	QSIMP-V
Ocimum tenuiflorum L.	Kala tulsi	Leaves	IHP
	Tulsi	Leaf	QASIMP
Oenothera biennis Linn	Oenothera	Leaf, Stem, Root	SHD-IV
Oldenlandia corymbosa Linn.	Parpata	Root, Stem, Leaf	PAD-XII
Oroxylum indicum (L.) Vent.	Sonapatha	Stem, Root, Leaf	MPWG
Oxalis corniculata Linn.	Cangeri	Whole plant	QSIMP-V
Paederia scandens(Lour.) Merr. syn.*P. foetida*auct. non Linn.;*P. tomentosa* Blume	Bacuchi	Leaf	PILD
	Prasarini	Root, Stem, Leaf	PID-II
	Bhumyamlaku	Whole plant	QSIMP-VIII
*Pavonia odorata*Willd.	Kasa visa	Whole plant	QSIMP-XI
Pedalium murex Linn.	Brihat Goksura	Root, Stem, Leaf, Fruit	PID-III
Pelargonium-graveolens Linn. Herit	Geranium	Leaf	MPLD-II
Pergularia daemia (Forsk.) Chiov.	Uttamarani	Root, Stem, Leaf, Fruit, Seed	PID-II
	Uthamakanya	Root & Leaf	PAD-XI
Peristrophe paniculata(Forssk.) Brummitt syn. *P. bicalyculata*(Retz.) Nees	Kakajangha	Whole plant	QSIMP-V
Phyla nodiflora(Linn.) Greene syn.*Verbena nodiflora*Linn.; *Lippia nodiflora*(Linn.) A. Rich.	Jalapippali	Whole plant	QSIMP-X
*Phyllanthus amarus*Schum. & Thonn.	Bhuiavla	Arial Tender	IHP
	Bhuiamla	Arial Part	QASIMP
	Sarala	Aerial parts	QSIMP-VIII
*Phyllanthus fraternus*Webst. syn.*P. niruri*auct. pl. non Linn.	Tamalaki	Whole plant	QSIMP-XIV
*Phyllanthus maderaspatensis*Linn.	Bhudhairi	Whole plant	QSIMP- II
Physalis minima Linn.	Tankari	Root, Stem Leaf	PAD-XII
Piper betle Linn.	Pan	Leaf	PILD
	Tambula	Leaf	MPLD-II
	Tambilba	Leaf	QSIMP-VII

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Pluchea lanceolata C.B. Clarke	Rasna	Leaf	MPLD-II
	Rasna	Leaf	QSIMP-IV
	Rasna	Root, Root Stock, Stem, Leaf	PID-II
Plumbago indica Linn.	Lalchitra	Stem, Root, Leaf	MPWG
Pogostemon patchouli Hook. F. non Pelletier	Patchouli	Leaf	MPLD-II
Pongamia pinnata (L.) Pierre.	Karanj	Leaf	SSDUM-V
Portulaca oleracea Linn.	Khurfa	Leaf & stem	SSDUM-I
	Brhat lonika	Whole plant	QSIMP-XIII
*Premna serratifolia*Linn.	Arni	Leaf	QSIMP-XIV
Prosopis cineraria(Linn.) Druce. syn.*P. spicigera*Linn.	Sami	Leaf	QSIMP-XIV
Punica garnatum Linn.	Dadima	Leaf, Fruit, Bark (Rt.&St.)	PID-III
	Dadima	Leaf	MPLD-II
*Raphanussativus*Linn.	Mulaka	Aerial parts	QSIMP-XII
Ricinus communis Linn.	Arand	Leaves& Root	IHP
	Eranda	Leaf, Root, Seed	QSIMP-X
Rosmarinus officinalis Linn.	Rosemary	Leaf	MPLD-II
Rotula aquatica Lour.	Pashanabheda	Stem, Root, Leaf	MPWG
Rubia cordifolia Linn.	Manjith	Stem, Root, Leaf	MPWG
Ruta graveolans\J\nn.	Suddaba	Leaf	MPLD-II
Salvadora oleoides Decne	Vrudh pilu	Leaf	MPLD-II
*Salvadora persica*Linn.	Pilu	Leaf	MPLD-II
syn.*S. wightiana*Bedd.;*S. indica*Wight;*Galenia asiatica* Burm. f.	Pilu	Leaf	QSIMP-VI
Salvia officinalis Linn.	Sage	Leaf	MPLD-II
Saraca asoca (Roxb.)de Wilde	Asok	Stem, Root, Leaf, Seed	MPWG
Sesbania bispinosa W.F. Weight.	Jayantibheda	Leaf	MPLD-II
Sesbania sesban(Linn.) Merr. syn.*S. aegytiaca*Pers.	Jayanti	Leaf, Pod	QSIMP-VI
Siegesbeckia orientalis Linn.	Siegesbeckia Orientalis	Leaf, Stem, Root	SHD-II
Solanum americanum Linn.	Makoi	Whole Plant	IHP
*Solanum anguivi*Lamk. syn.*S. violaceum*Ortega;*S. sodomeum*Linn.;*S. indicum* auct. non Linn.	Brhati	Whole plant	QSIMP-VII

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Solanum indicum Linn.	Brihati	Stem, Root, Leaf	SPAD
Solanum nigrum Linn.	Barg-e-Mako	Leaf	SSDUM-II
Solanum surattense Burm. f.	Katai	Leaf, Flower, Fruit, Seed	SSDUM-III
	Kantakari	Root, Stem, Leaf	PID-III
*Solanum torvum*Swartz	Sveta Brhati	Whole plant	QSIMP-VII
*Solanum villosum*Mill. ssp. *villosum*Edmonds syn.*S. nigrum*sensu Clarke, p.p., non Linn.	Kakamaci	Whole plant	QSIMP-VII
*Solanum virginiatum*Linn. syn.*S. xanthocarpum*Schrad. & Wendl.;*S. surattense* Burm. f.	Gulu	Whole plant	QSIMP-VIII
Solanum xanthocarpum Schrad & Wendl.	Kantkari	Stem, Root, Leaf	SPAD
	Kateli	Whole Plant	IHP
*Sphaeranthus indicus*Linn.	Nunditika	Dried Leaf	QSIMP-XIII
Spinacia oleracea Linn.	Palankya	Leaf	PID-II
Stevia rebaudiana(Bertoni) Bertoni	Stevia	Leaf	MPLD-II
	-	Leaf	QSIMP-IX
*Swertia angustifolia*Buch.-Ham. ex D. Don	Lavanga	Whole plant	QSIMP-VIII
Swertia chirayita(Roxb. ex Fleming) Karsten syn.*S. chirata*Buch.-Ham. ex C.B. Clarke	Chiraita	Leaf	SSDUM-II
	Chirayata	Whole Plant	IHP
	Chiretta	Whole Plant	PNLP
	Kiratalikta	Whole plant	QSIMP-IX
Syzygium cumini (Linn.) Skeels	Jamun	Leaf	SSDUM-V
Tamarindus indica L.	Tintrini	Stem bark and Petiole	PAD-XI
Tamarindus indica Linn.	TamarHindi	Leaf	SSDUM-V
*Taxus wallichiana*Zucc. syn.*T. baccata*auct. non Linn.	Sthaijneyaka	Leaf	MPLD-II
	Thuner	Leaves	PNLP
	Sthauneyka	Leaf	QSIMP- II
Tephrosia purpurea(Linn.) Pers.	Sharpunkha	Root, Stem, Leaf	PID-II
	Sharpunkha	Stem, Root, Leaf	SPAD
	Sharapunkha	Whole plant	QSIMP- I
*Terminalia alata*Heyne ex Roth syn.*T. tomentosa* (Roxb.) Wight & Arn.	Sain (Hindi, Pun.)	Leaf	QSIMP-VI
Terminalia arjuna (Roxb.) Wt. & Arn.	Arjuna	Leaf, Fruit	PID-I

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Thymus serpyllum Linn.	Wild thyme	Leaf	MPLD-II
*Thymus vulgaris*Linn.	Asvagola	Aerial parts	QSIMP-XI
Tinospora cordifolia (Willd.) Miers	Guduchi	Root, Stem, Leaf	PID-I
Trachyspermum ammi (L.) Sprague	Ajwain	Leaf	SSDUM-IV
Tragia involucrata Linn.	Vrscikali	Leaf	MPLD-II
*Trianthema decandra*Linn. syn.*Zaleya decandra*(Linn.) Burm. f.	-	Whole plant	QSIMP-XI
Trianthema portulacastrum Linn. syn. *T. monogyna* Linn.	Svetapunarnava	Whole plant	QSIMP- II
Trichosanthes cucumerina Linn	Patola	Stem, Leaf Fruit, Seed	PID-II
Trichosanthes diocia Roxb.	Patola	Leaf	MPLD-II
	Palval	Leaf	PILD
Trichosanthes lobata Roxb.	Jangali cicinda	Stem, Root, Leaf	MPWG
*Tridax procumbens*Linn.	Ghamsa	Whole plant	QSIMP-X
Tylophora indica (Burm. f.) Merrill syn.*T. asthmatica* (Linn. f.) Wight & Arn.	Arkaparni	Leaf	MPLD-II
	Tylophora Indica	Leaf	SHD-III
	Arakaparani	Leaf	QSIMP- I
Urginea indica Kunth. (=*Scilla indica* Baker)	Squill	Leaf	PILD
*Vanda coerulea*Griff. ex Lindl	Blue vanda	Leaf & Flowers	PNLP
Vanda tessellate (Roxb.) Hook. ex G. Don.	Rasna	Root, Root Stock, Stem, Leaf	PID-II
Vernonia cineria Less.	Sahadevi	Leaf, Heads, Flower	PAD-VI
*Vernonia conyzoides*DC. syn.*V. cinerea*auct. non Less.	Sohadevi	Whole plant	QSIMP-VII
Viola odorata Linn.	Banafsha	Leaf	SSDUM-V
	Banapsa	Whole plant	QSIMP-XIII
*Vitex agnus-castus*Linn.	Chaste Tree	Leaf	QSIMP-X
Vitex negundo Linn.	Nirgundi	Leaf	PID-II
	Berg-e-Sambhalu	Leaf	SSDUM-III
	Nirgundi	Leaf	MPLD-II
	Nirgundi	Leaf	QSIMP- III
Vitex peduncularis Wall.	Nagbail	Leaf	PILD
Vitex trifolia Linn.	Surasa	Leaf	MPLD-II
Wattakaka volubilis (Linn.) Stapf	Madumalathi	Leaf	PAD-XII
Wedelia chinensis(Osbeck) Merrill syn.*W. calendulacea*Less.	Pitabhringaraja	Leaf	MPLD-II
	Bhrngrajapita	Leaf, Stem	QSIMP- I
Wrightia tinctoria R.Br.	Swetakutaj	Leaf	MPLD-II

Botanical Name (as specified in references/ literature)	Name of the drug	Morphological Part specified as drug	Reference
Zataria multiflora Boiss.	Satar Farsi	Leaf	SSDUM-IV
Zizyphus jujuba (L.) Gaertn.	Ber	Leaf	SSDUM-V

*Pharmacognosy of Whole plant comprise Pharmacognosy of Arial parts (leaf, stem, flower, fruit, seed etc.) and underground parts (Root, Rhizome etc.) of plants

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