HIPPOCRATIC JOURNAL OF UNANI MEDICINE

Volume 7, Number 1, January – March 2012

Hippocratic J. Unani Med. 7(1): 1-154, 2012

CENTRAL COUNCIL FOR RESEARCH IN UNANI MEDICINE
Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH)
Ministry of Health & Family Welfare, Government of India

Hippocratic Journal of Unani Medicine

Editorial Office

CENTRAL COUNCIL FOR RESEARCH IN UNANI MEDICINE
61-65 Institutional Area (Opposite 'D' Block), Janakpuri, New Delhi – 110 058, India
Tel.: +91-11-28521981, 28525982, 28525831/52/62/83/97, 28520501, 28522524, Fax : +91-11-28522965
Website : http://unanimedicine.com • Email : unanimedicine@gmail.com & ccrum@rediffmail.com

Annual Subscription: Rs. 300/- (India) US $ 100/- (Other Countries) **Single Issue:** Rs. 150/- (India) US$ 50/- (Other Countries)
Payments in respect of subscription may be sent by bank draft marked payable to Director General, CCRUM, New Delhi.

On behalf of Central Council for Research in Unani Medicine (CCRUM) published and printed by Prof. S. Shakir Jamil Director General, CCRUM at CCRUM headquarters, 61-65 Institutional Area (Opposite 'D' Block), Janakpuri, New Delhi – 110058 and printed at India Offset Press, A-1 Mayapuri Industrial Area Phase-1, New Delhi 110 064 (INDIA)

Contents

Editorial

In view of the contemporary global interest generated in Traditional Medicines (TM's), it is also important to establish their curative strengths through scientific validations and toxieological studies. Only a scientifically validated Traditional Medicine can become an integral part of the futuristic medicine and contribute significantly to the ongoing international endeavour against present day health challenges. Over the years, a large number of traditional drugs, mainly herbal, have been subjected to clinical, pharmacological, phytochemical and pharmaceutical studies in an effort to validate them and prove their medical efficacy and safety. All these investigations have yielded extensive and valuable findings and insights, and there is a need for wide exchange of this information among scientists engaged in the development of new drugs of natural origin.

Unani system of Medicine, although originated in Greece, is one of the recognized systems of medicine of the country. Although, the Unani medicine have been in use for centuries and are known for their therapeutic efficacies, there is a need to scientifically establish their efficacy and safety in order to achieve global acceptance. Organized research work in this system was, therefore, a need of the hour. In post independent era, Central Council for Research in Unani Medicine, through its clinical, drug research, literary research, survey & cultivation of medicinal plants programme is contributing significantly for last three decades. *Vitiligo, Sinusitis, Filariasis, Eczema, Malaria, Infective Hepatitis, Asthma*, are some of the conditions where Unani therapies have earned recognition after scientific validation.

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

On account of an overwhelming response, the journal earlier published twice a year, its periodicity has now 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, Clinical and experimental pharmacological studies, standardization of single and compound drugs, development of standard operating procedures, ethnobotanical studies, experimental studies on medicinal plants 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 provides 12 original research and review papers in the areas of clinical research, drug standardization, pharmacology, ethnobotanical surveys 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.

(Prof. S. Shakir Jamil)
Editor-in-Chief

Clinical Evaluation of Efficacy of a Unani Formulation in *Waja-ul-Mafasil* "Rheumatoid Arthritis

[*1]Qamar Uddin, [1]L. Samiulla and [2]Fasihuzzama

[1]Regional Research Institute of Unani Medicine, Mathasahi, Bhadrak-756100, Odisha

[2]Department of Moalijat, Faculty of Medicine (Unani), Jamia Hamdard, New Delhi-110062

Abstract

In the classical *Unani* texts, *Waja-ul-Mafasil* is broadly explained and well correlated with a chronic inflammatory joint disease, rheumatoid arthritis (RA). The exact aetiology of rheumatoid arthritis is still unknown and there is no curative treatment for this chronic, painful, disabling disorder. In *Unani* system of medicine, many single drugs *(Mufrad Adviyah)* as well as compound formulations *(Murakkab Adviyah)* are being prescribed since ages for the treatment of *Waja-ul-Mafasil*. Therefore, a randomized, controlled, single-blind clinical trial was conducted to evaluate the therapeutic efficacy of three *Unani* herbal drugs (*Withania somnifera*, *Piper nigrum*, and *Datura fastuosa*) in comparison to a control drug (Aspirin) in patients of *Waja-ul-Mafasil*. The study was carried out on 40 patients of *Waja-ul-Mafasil*. The symptoms and signs of the disease after 21 days of treatment showed significant improvement with no adverse effects of test drugs in comparison to control drug. The study is affirmative of the therapeutic efficacy and safety of the *Unani* test drugs combination in patients of *Waja-ul-Mafasil*. However, there is a need to carry out further study with a large sample size and with assessment of effect on specific anti-TNF antibodies to establish the possible curative treatment to tackle this global problem.

Keywords: Rheumatoid arthritis, *Wja-ul-Mafasil*, Unani Medicine, Anti-TNF antibody, TNF Antagonists

Introduction

Rheumatoid arthritis (RA) is a chronic multisystem disease of unknown aetiology characterized by a destructive and deforming polyarthritis, mainly affecting peripheral synovial joints, usually in a symmetrical pattern and a variety of non-articular manifestations (McGee *et al*., 1992; Kasper *et al*., 2005; Boon *et al*., 2006). RA is a disease of the synovium and is a condition of synovioarthritis in contrast to osteoarthritis (Dey and Dey, 2005). However, late in the disease, degenerative changes in the abnormal cartilage lead to secondary osteoarthritis in rheumatoid joint (McGee *et al*., 1992). Rheumatoid arthritis occurs worldwide in all ethnic groups and it is estimated that about 1% of the world's population is afflicted by RA (Wngaarden *et al*., 1992; Kasper *et al*., 2005; Boon *et al*., 2006; Kumar *et al*., 2006). Rheumatoid arthritis may begin at any age (McPhee *et al*., 2007) from 10 to 70 years (Kumar and Clark, 1996) but the usual age at onset is 35 to 50 years (Kasper *et al*., 2005). Over

[*]Author for correspondence

70% of the patients are women (Ritchie, 1990; Cree, 1997). The risk factors for RA are cigarette smoking and female gender and this susceptibility is increased post-partum and by breast feeding, positive SRF in non-RA subjects (Boon *et al*., 2006).

Rheumatoid arthritis is an autoimmune disease. Arthritis of RA is caused by immune complexes which are localized within the inflamed cartilage and activate the complement system and generate–anaphylatoxins (permeability increasing components of C3a and C5a) and chemotactic factors (C5a). These complement activation products induce emigration (anaphylatoxins) and chemotaxis (C5a) of neutrophils and monocytes which phagocytose the immune complexes and release inflammatory mediators (cytokines) and lysosomal enzymes (collagenase and elastase) which destroy the articular cartilage and synovium. The most important cytokines are *tumour necrosis factor* α *(TNF-*α*)*, *interleukin-1 (IL-1), prostaglandin-E2 (PGE2), leukotriene-B4 (LTB4), and O2 radicals* which act as mediators of joint injury (Anderson, 1987; Kumar *et al*., 2006). Immune complexes produced within the synovium and entering the circulation are responsible for the extra-articular manifestations of RA (Anderson, 1987).

Chronicity and destructive potential are characteristic features of the inflammatory response in the synovial membrane typical for RA (Anderson, 1987). Rheumatoid arthritis begins with acute inflammation of the synovium in the joints involved and the acute reaction is soon replaced by chronic inflammation (Ritchie, 1990; Russel *et al.,* 2004). Chronic synovitis is followed by neovascularization of the inflamed synovium leading to 'pannus' formation that is a hallmark of RA (Stupack *et al*., 1999). This is followed by destruction of articular cartilage, subchondral bone, and bone at the sides of the joint leading to joint damage that may be identified only months after the onset of symptoms (Bresnihan, 1999). Progressive joint damage may lead to fibrous ankylosis, bony ankylosis and subsequently deformity of the involved joint (MacSween and Whaley, 1992). Joint deformities include ulnar deviation, "Z" deformity, 'Swan Neck' deformity, Boutonnière (Button-Hole) deformity, forefoot widening, hallux valgus, and valgus deformity of the foot and knee (Weatherall *et al*., 1996; Kasper *et al*., 2005).

Rheumatoid arthritis is mentioned in classical Unani literature as *'Waja-ul-Mafasil'*. *Waja-ul-Mafasil'* is a pain or an inflammation *(Waram)* which occurs in the joints of hands and feet, knee joints and ankle joints (Majoosi, 1889; Ali, 1896; Jurjani, 1903). Shaikh Bu Ali Sina (Avicenna) (980-1036 AD) mentioned that *Waja-ul-Mafasil* is caused by phlegm *(Balgham)*, blood *(Dam)*,

yellow bile *(Safra)*, and black bile *(Sauda)* in a decreasing order of frequency, respectively. *Waja-ul-Mafasil* is commonly caused by accumulation of sticky phlegm *(Balgham-e-Lazij)* in the joints due to weakness of the joints *(Zof-e-Mafasil)* (Majoosi, 1889; Khan, 1939). *Madda* (substance) causing *Waja-ul-Mafasil* enters the joints and it neither digests nor expels from them due to lack of power of digestion *(Quwwat-e-Hazima)* and power of expulsion *(Quwwat-e-Dafia)* in the joints, respectively and thus, it is retained in the joints leading to disturbance in the metabolic activity, hence the nutrients reaching the joints are not properly utilized, instead they are converted into harmful products which induce inflammatory process. Thus, the *Waja-ul-Mafasil* is developed (Jurjani, 1903). When this *Madda* (substance) is retained in the joints for a long period, its viscosity *(Ghilzat)* and viscidity *(Luzoojat)* are increased and it becomes stone (*Tahajjur-e-Mafasil* or Osteoarthritis) and the condition is incurable (Majoosi, 1889). When the *Madda* (substance) which produces *Waja-ul-Mafasil* enters the blood and permeates the entire body system, the non-articular manifestations are developed (Majoosi, 1889; Khan, 1939).

The exact aetiology of rheumatoid arthritis is still unknown and there is no curative treatment for this chronic, painful, disabling disorder. Moreover, synthetic drugs used as anti-rheumatic and anti-inflammatory agents have serious adverse effects and even fatalities are due to iatrogenic effects of allopathic treatment–in particular, gastrointestinal bleeding related to long-term use of anti-inflammatory drugs (aspirin, non-steroidal anti-inflammatory drugs) and infections associated with chronic steroid use and treatment with cytokine antagonists (TNF antagonists) (Kumar *et al*., 2006). Classical literature of Unani system of medicine is replete with many single drugs *(Mufrad Adviyah)* as well as compound formulations *(Murakkab Adviyah)* which have been used by eminent Unani physicians for the treatment of *Waja-ul-Mafasil*, but there is no scientific validation of these classical textual claims. Hence, there was ample need to search for some Unani drugs which could be safe and effective in the treatment of *Waja-ul-Mafasil*. Therefore, the study was carried out to scientifically validate a Unani herbal compound formulation for its safety and efficacy in the treatment of *Waja-ul-Mafasil*.

Methodology

The study was designed as a randomized, controlled, single-blind clinical trial. The present study was conducted at Majeedia Hospital, New Delhi on 40 patients of *Waja-ul-Mafasil*. The patients suffering from *Waja-ul-Mafasil* were selected by adopting clinical criteria for diagnosis of rheumatoid arthritis

revised (1988) by the American Rheumatism Association (ARA). The patients of either sex in the age group of 16 to 55 years were included in the study. Inclusion criteria were morning stiffness of at least 1 hour duration, arthritis of 3 or more joint areas, arthritis of hand joints, symmetric arthritis, rheumatoid nodules, serum rheumatoid factor, and typical radiographic changes in the hand and wrist. Patients with four or more of the above 7 features of 6 weeks or more duration were included in the clinical trial. Exclusion criteria included extra-articular manifestations, joint deformities, advanced radiological lesions, malnourished patients, pregnant women and lactating mothers. After necessary ethical clearance and written informed consent, patients were enrolled for the treatment. Laboratory investigations were conducted including Hb, TLC, DLC, platelets, ESR, serum rheumatoid factor, and X-ray of the affected joint. The investigations were repeated after treatment. The safety of trial drugs was evaluated clinically by monitoring adverse effects which were carefully sought at each follow-up. The temperament (*Mizaj*) of the patients was assessed as per the parameters described in Unani classical literature.

A total of 40 patients, 20 in each group, were randomly allocated to the test ('X') and control group ('Y'). A tri-herbal Unani formulation in the form of capsule was administered orally to all the 20 cases of test group ('X') in the dose of 2 capsules (700 mg each) thrice daily (4.2 g/d) after meals. Each capsule contained fine powder of 3 herbs: *Withania somnifera* (Asgandh)–500 mg, *Piper nigrum* (Filfil Siyah)–150 mg, and *Datura fastuosa* (Jauz-e-Masil)–50 mg. All the 20 cases in control group ('Y') were advised to take a control drug, Aspirin orally with milk in the dose of 1 g four times daily after meals. The duration of treatment was 21 days in both the test and control groups. No concomitant treatment was allowed during the study. The follow-up of all the cases was carried out at regular interval of 7 days up to 21 days on the basis of clinical history and physical examination. The observations and results obtained in both the test ('X') and control ('Y') groups were tabulated and statistically analyzed.

Results and Discussion

The highest number of cases belonged to phlegmatic temperament (*Balghami Mizaj*) in both groups (Fig. 1). This observation was in accordance with the aetiology of *Waja-ul-Mafasil* described in Unani classical texts and it shows that the persons of *Balghami Mizaj* are more prone to develop *Waja-ul-Mafasil*. The highest incidence of disease was observed in the age group of 36–45 years and in females in both groups (Figs. 2 & 3).

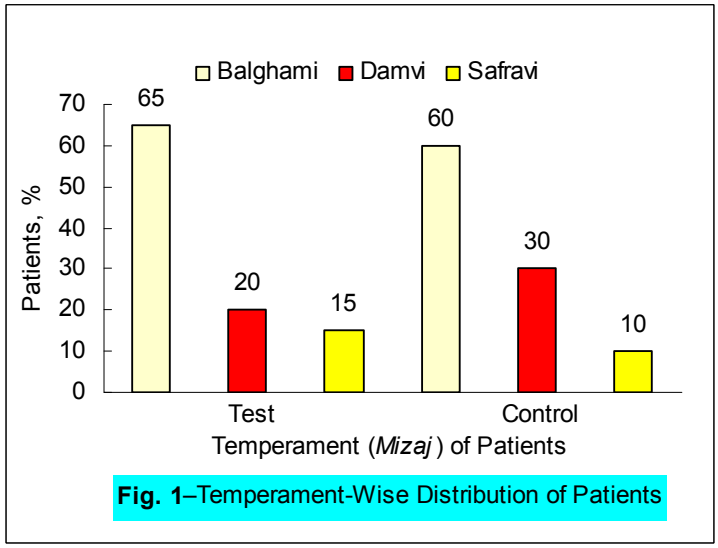


Fig. 1–Temperament-Wise Distribution of Patients

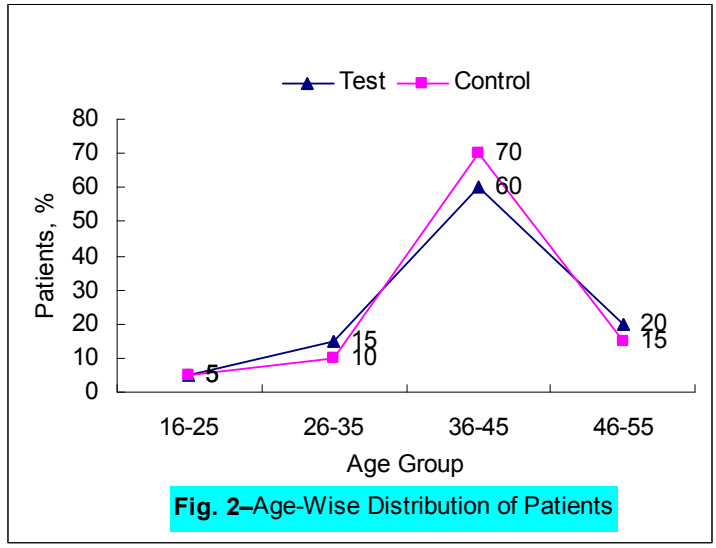


Fig. 2–Age-Wise Distribution of Patients

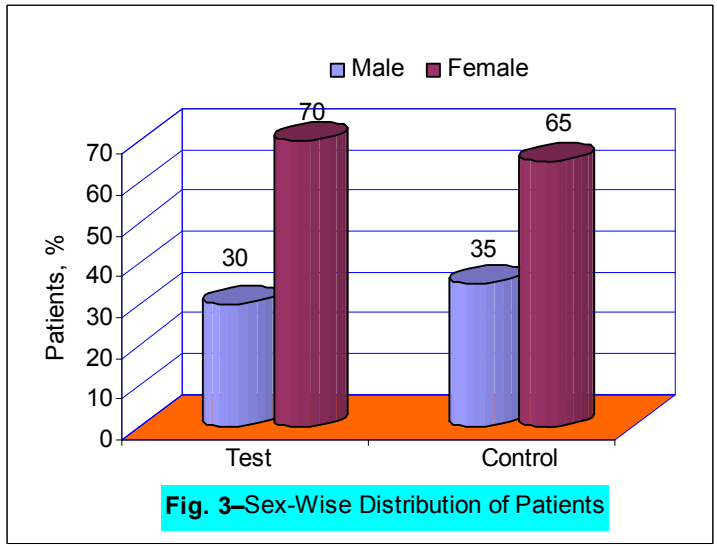


Fig. 3–Sex-Wise Distribution of Patients

A positive family history of RA was reported in 10% and 5% of patients in test and control groups respectively. The maximum numbers of patients were from urban areas in both groups. This may be due to the sedentary lifestyle among them which is a predisposing factor described in Unani classics. The highest incidence of disease was observed in winter which may be due to temperature effect (Table 1). The 25% and 30% patients were smokers in test and control groups respectively. The 60% and 65% patients were obese in test and control groups respectively. This observation indicates that the smoking and obesity may be the potential triggers of RA. The most commonly affected joints were PIP, MCP, and knee joints in both groups (Table 2).

Table-1. Distribution of Patients according to Family History of RA, Geographic Distribution and Seasonal Occurrence

Variables	Test Group ('X')		Control Group ('Y')	
	No. of Patients	Percentage (%)	No. of Patients	Percentage (%)
Family History–				
Positive	02	10	01	05
Negative	18	90	19	95
Area–				
Urban	14	70	12	60
Rural	06	30	08	40
Season–				
Winter	13	65	12	60
Other	07	35	08	40

After the completion of 21 days of treatment, the test drugs combination exhibited significant improvement in symptoms and signs of disease. Clinical remission based on the American College of Rheumatology (ACR) criteria, i.e. relief from joint pain was achieved in 14 cases (70%) in test group and in 12 cases (60%) in control group; relief from morning stiffness was achieved in 15 cases (75%) in test group and in 13 cases (65%) in control group; relief from joint tenderness was achieved in 16 cases (80%) in test group and in 13 cases (65%) in control group; relief from soft tissue swelling was achieved in 13 cases (65%) in test group and in 12 cases (60%) in control group (Table 3) and relief from fatigue was achieved in 14 cases (87.5%) in test group and not in any case in control group. Relief from generalized weakness was achieved in 13 cases (92.86%) in test group and in 3 cases (30%) in control group and

relief from anorexia was achieved in 13 cases (86.67%) in test group and in 2 cases (18.18%) in control group (Table 4). Erythrocyte sedimentation rate (ESR) showed significant reduction after treatment that was found to be 34.21% and 15.63% in test and control groups respectively (Table 5). Increase in haemoglobin (Hb) after treatment was recorded to be 19.67% and 2.1% in test and control groups respectively (Table 6).

Table-2. Distribution of Patients according to Predisposing Factors and Joints Involved

Variables	Test Group ('X')		Control Group ('Y')	
	No. of Patients	Percentage (%)	No. of Patients	Percentage (%)
Predisposing Factors–				
Smoking	05	25	06	30
Obesity	12	60	13	65
Joints Involved–				
PIP & MCP Joints	20	100	19	95
Knee	19	95	18	90
Wrist	17	85	16	80
MTP Joints	15	75	14	70

No adverse effects of the test drugs combination were reported by any of the patients over the treatment period and so the trial Unani drugs can be considered to be safe. The effectiveness of the trial drugs is indicative of their anti-arthritic activity. The control drug showed no effect on fatigue and its side-effects including nausea, vomiting, heartburn and dyspepsia were observed in most of the cases. The response was observed better in the early and middle stages of the disease where there were no gross structural changes in the affected joints. In cases where the structural damage had occurred, the drug was less effective in restoring the normalcy of the affected joints.

Table-3. Clinical Parameters before and after Treatment

Parameter	Day of Estimation	Number of Patients (Group-Wise)					
		Test Group ('X')			Control Group ('Y')		
		No. of Pts (N=20)	%	Response	No. of Pts (N=20)	%	Response
Joint Pain	Baseline	20	100	14 (70%)	20	100	12 (60%)
	After Treatment	06	30		08	40	

Parameter	Day of Estimation	Number of Patients (Group-Wise)					
		Test Group ('X')			Control Group ('Y')		
		No. of Pts (N=20)	%	Response	No. of Pts (N=20)	%	Response
Morning Stiffness	Baseline	20	100	15 (75%)	20	100	13 (65%)
	After Treatment	05	25		07	35	
Joint Tenderness	Baseline	20	100	16 (80%)	20	100	13 (65%)
	After Treatment	04	20		07	35	
Joint Swelling	Baseline	20	100	13 (65%)	20	100	12 (60%)
	After Treatment	07	35		08	40	

Table-4. Other Clinical Parameters before and after Treatment

Parameter	Day of Estimation	Number of Patients (Group-Wise)					
		Test Group ('X')			Control Group ('Y')		
		No. of Pts (N=20)	%	Response	No. of Pts (N=20)	%	Response
Fatigue	Baseline	16	80	14 (87.5%)	12	60	00 (0%)
	After Treatment	02	10		12	60	
Generalized Weakness	Baseline	14	70	13 (92.86%)	10	50	03 (30%)
	After Treatment	01	05		07	35	
Anorexia	Baseline	15	75	13 (86.67%)	11	55	02 (18.18%)
	After Treatment	02	10		09	45	

Table-5. Effect on ESR in both Groups

Treatment Group	Statistics			
	N	Mean ESR (mm/hr)		Reduction in ESR after Treatment (%)
		Baseline	After Treatment	
Test	20	38	25	34.21
Control	20	32	27	15.63

N= Number of Subjects

Table-6. Effect on Haemoglobin in both Groups

Treatment Group	Statistics			
	N	Mean Hb (g/dL)		Increase in Hb after Treatment (%)
		Baseline	After Treatment	
Test	20	10.78	12.9	19.67
Control	20	10.95	11.18	2.1

N= Number of Subjects

Conclusion

On the basis of above findings, it can be concluded that the trial Unani drugs are effective in the treatment of *Waja-ul-Mafasil* but chronicity of disease has the negative effect on response to therapy. The cases with early and middle stages of the disease have shown better response to treatment than cases with advanced disease. It is also observed that the trial drugs are well tolerated and have no adverse effects. The overall conclusion is that the trial Unani drugs are safe and possess potent anti-rheumatic, analgesic, and anti-inflammatory actions, which are of prime importance in the management of *Waja-ul-Mafasil*. Hence, these drugs can serve as a good alternative in the treatment of *Waja-ul-Mafasil*. However, there is a need to carry out further study with a large sample size and with assessment of effect on specific anti-TNF antibodies to establish the possible curative treatment to tackle this global problem.

References

Ali Mazhar, 1896. Moalijat-e-Mazhari (Ilajul Masakeen). Matba Iftekhar, Delhi, pp. 176-178.

Anderson, J.R., 1987. Muir's Textbook of Pathology. 12th Edn., Edward Arnold (Publishers) Ltd, Bedford Square, London, pp. 23.40-23.42, 23.46, 23.57, 23.59.

Boon, N.A., Colledge, N.R., Walker, B.P. and Hunter, J.A.A., 2006. Davidson's Principles and Practice of Medicine. 20th Edn., Churchill Livingstone, Elsevier Ltd., Philadelphia, pp.363-365.

Bresnihan, B., 1999. Pathogenesis of Joint Damage in Rheumatoid Arthritis. *Journal of Rheumatology* 26 (3): 717-719.

Cree Ian, 1997. Pathology. 1st Edn., Chapman & Hall, London, pp. 157-162, 542-554.

Dey, N.C. and Dey, T.K., 2005. A Textbook of Pathology. 15th Edn., New Central Book Agency (Pvt.) Ltd., Calcutta, pp. 34.2-34.5.

Jurjani Ahmed Hasan, 1903. Zakhira-e-Khawarzam Shahi. Vol. 6, Urdu Translation by Hkm Hadi Husain Khan, Munshi Nawal Kishore, Lucknow, pp. 637-648.

Kasper, D.L., Braunwald, E., Fauci, A.S., Hauser, S.L., Longo, D.L. and Jameson, J.L., 2005. Harrison's Principles of Internal Medicine. 16th Edn., McGraw-Hill Companies, USA, Vol. I, pp. 1260-1263.

Khan Mohammad Azam, 1939. Ikseer-e-Azam (Al-Ikseer). Urdu Translation by Hkm Kabiruddin, Tibbi Company, Jama Masjid Road, Rawalpindi, Pakistan, Vol. II, pp. 1430-1448.

Kumar Parveen and Clark Michael, 1996. Clinical Medicine. 3rd Edn., W.B. Saunders Company, Philadelphia, pp. 379-393.

Kumar, V., Abbas, A.K. and Fausto, L.D., 2006. Robbins & Cotran Pathologic Basis of Disease. 7th Edn., Saunders, Elsevier, USA, pp. 409-410.

MacSween, R.N.M. and Whaley, K., 1992. Muir's Textbook of Pathology. 13th Edn., Edward Arnold (Publisher) Ltd., Bedford Square, London, pp. 984-994.

Majoosi Abulhasan Ali Ibn Abbas, 1889. Kamil-us-Sanaah. Urdu Translation by Kantoori G.H., Matba Munshi Nawal Kishore, Lucknow, pp. 507-514, 543-547.

McGee, J'.O.D., Isaacson, P.G. and Wright, N.A., 1992. Oxford Textbook of Pathology. 1st Edn., Vol. 2b, Oxford University Press, Oxford, pp. 2073-2075, 2081-2087.

McPhee, S.J., Papadakis, M.A. and Tierney, L.M., 2007. Current Medical Diagnosis and Treatment (CMDT). 46th Edn., McGraw-Hill Company, USA, pp.1553-1555.

Ritchie, A.C., 1990. Boy'd Textbook of Pathology. 9th Edn., Vol. II, K.M. Varchese Company, Bombay with Lea & Febiger, Philadelphia, pp. 1922-1925.

Russel, R.C.G., Williams, N.S. and Bulstrode, C.J.K., 2004. Bailey & Love's Short Practice of Surgery. 24th Edn., Hodder Education, Edward Arnold, London, pp. 162-165, 980-982.

Stupack, D.G., Storgard, C.M. and Cheresh, D.A., 1999. The Role of Angiogenesis in Rheumatoid Arthritis. Braz. *J. Med. Biol. Res.* 32 (5): 573-581.

Weatherall, D.J., Ledingham, J.G.G. and Warrell, D.A., 1996. Oxford Textbook of Medicine. 3rd Edn., Vol. 3, Oxford University Press, Oxford, pp. 2953-2964.

Wyngaarden, J.B., Smith, L.H. and Bennett, J.C., 1992. Cecil Textbook of Medicine. 19th Edn., W.B. Saunders Companies, Philadelphia, pp. 2015-2017.

Clinical evaluation of Babchi (*Psoralea corylifolia Linn.*) in Bars (Vitiligo) - An Open Study

[*1]Syed Shamsul Hasan Tariq,
[2] Shagufta Aleem and
[3]Tabassum Iatafat

[1]Government Unani Dispensary, Department of Unani Medicine, Majajpur, Weir, Bharatpur – 321406 (Rajathan), India

[2]Department of Amraaz-e-Jild wa Amraaz-e-Zohrawiya, A.K. Tibbiya College, Aligarh Muslim Univerisity, Aligarh-202002, India.

[3]Department of Moalejat, A.K. Tibbiya College, Aligarh Muslim University, Aligarh-202002, India.

Abstract

Vitiligo is a progressive disorder in which some or all of the melanocytes in the affected skin are selectively destroyed. Vitiligo affects 0.5-2% of the world population, and the average age of onset is 20 years. In the view of available literature of Unani medicine herbal drug *Babchi* (*Psoralea corylifolia* Linn.) which is claimed to be effective in this ailment were used in powdered form for the trial. To evaluate the efficacy of the drug 40 patients of Bars (Vitiligo) between 10-60 age groups was selected on the basis of clinical diagnosis and investigations. The clinical assessment was done in term of relief in sign and symptoms. The duration of study was 60 days. The clinical result suggested that the oral use and local application of the medicated paste of Babchi is effective in treating the vitiligo with no side effects during the course of study.

Key words: Vitiligo, Bars, Babchi, *Psoralea corylifolia.*

Introduction

The term vitiligo has been derived from the Latin word *vitelius* meaning calf. The characteristic white patches of spotted calf. The term was first used by Celsus, a Roman physician of 2nd century AD (Valia, 2001). Al-Majoosi in his master piece Kamil-us-Sana'a says that Bars is a whiteness occurring in outer surface of the body. Sometimes it occurs in few organs, sometimes it affects all organs. The disease occurs due to the domination of phlegmatic humor in the blood and due to weakness in Quwwat-e-Mughaiyirah (transformative faculty) in the organ. (Majoosi, 930-994 AD). According to Ibne-Sina, defect lie at the tissue level in the function of Quwwat-e-Mushabbeha. Therefore due to the failure of this power, depigmentation occurs. (Ibne Siena, 980-1037 AD). To the ancient Unani physicians, it is a metabolic disorder resulting mainly due to humoral derangement, excess of Balgham (phlegm), weakness of Quwwat-e-Mughaiyarah, Quwwat-e-Mushabbiha and Quwwat-e-Dafia (transformative, homogenizing, and expulsive faculties). (Ajmal Khan, 1864-1927 AD). All the Unani physicians are of the opinion that the treatment of the vitiligo should be started with Tanqiyah-e-Badan (removal of harmful material from the body). The role of diet restriction and recommendations are well documented in the classics of Unani literature in the management of vitiligo. Mostly Munzij-e-Balgham with Mushil is given in the management of vitiligo which plays a vital role in correcting the humoral derangement. Unani physicians are also aware of the fact that exposure to the sun activates the process pigmentation. (Zakariya Raazi, 850-925 AD; Majoosi, 930-994 AD).

*Author for correspondence

Vitiligo is an acquired, disfiguring patchy loss of skin pigment. This is usually progressive acquired acroleucopathia and melanocytopenia of unknown causes which is often familial and is characterized by pale white macular patches which enlarge centrifugally Diagnosis of the vitiligo is usually easy and can be made by clinical experience. The diagnosis is based on age of onset, distribution, depigmented macules, leucotrichia, Koebner's phenomenon and predilection for the site of trauma. (Champion *et. al.*, 1998; Arnold, 1990; Cohen *et*. *al*., 1999).

Inspite of advancement in the treatment of vitiligo in modern system of medicine, there is no cure for vitiligo. So there is need to search for some safe and effective remedies from natural sources either plants, minerals or animal source. The Unani drugs are proved to be effective in the treatment of Bars (Vitiligo) for hundred of years. Hence study was planned to evaluate the therapeutic efficacy of single drug Babchi (Psoralea corylifolia Linn.) in the treatment of Bars (Vitiligo).

Methodology

This study was carried out on 40 cases of vitiligo in the outdoor sections of Moalejat, Ajmal Khan Tibbiya College Hospital, AMU Aligarh U.P during the period extending from 2006-2007.The cases below 10 years, patients on active vitiligo treatment with other drugs, known allergies, with other skin diseases and non co-operative patients were excluded from the study. All the cases were informed about the duration of the study, the expected benefits, and the adverse effects of the drugs to be used. The diagnosis of the vitiligo was made on the basis of clinical history, physical examination and investigations like, stool examination, skin scrapping (KOH smear) and skin biopsy (in few cases). Five grams of *Babchi* powder is mixed with 50ml of water and advice the patient to drink its zulal (filtered water) and medicated paste was prepared by mixing the sufl (precipitate) with sirka-e-jamun and then applying this paste over the vitiligo patches. The patch was then exposed to sunlight for at least 30 minutes. The paste was washed off after 30 minutes of the topical application. The duration of study was 60 days. The follow up of all the cases was carried out at the interval of 15 days i.e. 0, 15, 30, 45, 60 days.

Observations

Forty patients of either sex in the age group of 10 to 60 years were taken in the clinical trial, and the effect of Unani single drug Babchi was assessed

depending on the above mentioned parameters. Out of forty patients 22 (55%) were males and 18(45%) females. It has been observed that maximum number of patients were in the age group of 10-20 years 17 (42.5%) (Table 1).

Table-1. Showing Distribution of Patients According to Age and Sex

Age Group (in years)	No. & % of patients		No. & Percentage
	Males	Females	
10 – 20	10(25)	7(17.5)	17(42.5)
21 – 30	5(12.5)	4(10)	9(22.5)
31 – 40	2(5)	4(10)	6(15)
41 – 50	3(7.5)	1(2.5)	4(10)
51 – 60	2(5)	2(5)	4(10)
Total	22(55)	18(45)	40(100)

Results and Discussion

Forty patients suffering from Bars (vitiligo) were treated with single unani drug Babchi along with the local application of medicated paste for a period of 60 days. The response of the drug was assessed on the basis of clinical sign and symptoms, the drug was found very effective in the treatment of Bars (Vitiligo).

The maximum number of patients registered are unmarried 24 (60%). (Table 2). The maximum number of patients according to occupation are students 14 (35%). (Table 3). Out of 40 patients 40% belongs to the lower class group. (Table 4). It has been observed that out of 40 patients 17 (42.5%) of patients has positive history of trauma and pressure. (Table 5). The maximum number of patients 25 (62.5%) have the multiple number of patches. (Table 6). Out of 28 (70%) of the patients there are symmetrical distribution of patches. (Table 7). Similarly out of 40 patients the maximum number of patients 8 (20%) have the facial distribution of vitiligo patches (Table 8).

Table-2. Showing Distribution of Patients According to Marital Status

Marital Status	No. of patients	Percentage
Married	16	40
Un-married	24	60

Table-3. Showing Distribution of Patients According to Occupation

Occupation	No. of patients	Percentage
Business	10	25
Housewives	7	17.5
Service	3	7.5
Students	14	35
Others	6	15

Table-4. Showing Distribution of Patients According to Socio-Economic Status

Socio-Economic status	No. of Patients	Percentage
Lower Class	16	40
Middle Class	14	35
Higher Class	10	25

Table-5. Showing Distribution of Patients According to History of Trauma and Pressure

History	No. of Patients	Percentage
Trauma & Pressure	17	42.5
Negative History	23	57.5

Table-6. Showing Distribution of Patients According To Number of Patches

H/o of Vitiligo patches	No. of Patients	Percentage
Single	15	37.5
Multiple	25	62.5

Table-7. Showing Distribution of Patients According to Symmetric/Non Symmetric Patches

H/o of Vitiligo patches	No. of Patients	Percentage
Symmetric	28	70
Non Symmetric	12	30

Table-8. Showing Distribution of Patients According To First Part of the Body Affected

Parts of body involved	No. of Patients	Percentage
Scalp and Forehead	6	15
Face	8	20
Neck	3	7.5
Chest (Breasts, Nipples)	5	12.5
Back	4	10
Upper limbs	4	10
Lower limbs	7	17.5
Abdomen	3	7.5
Genitals (Scrotum, Vagina, Perineal region)	00	00

The response of the drug was observed in clinical sign and symptoms of Bars (Vitiligo) patients. Of the clinical parameters evaluated depigmented white patches, depigmented pink patches, loss of hairs over patches, white hairs over patches, new eruptions over patches , itching, burning and photosensitivity showed 71.4%, 66.6%, 62.5%, 33.3%, 36.3%, 53.3%, 60%, 70% improvement respectively (Table 9).

Table-9. Showing therapeutic response of Drug on Clinical features of the Disease

Clinical Features	No. of Patient (s) (Before treatment) 0 day	No. of Relieving cases & Percentage of improvement
	Before treatment) 0 day	(After treatment) 60^{th} day
Depigmented white patches	28	20(71.4)
Depigmented pink patches	12	8(66.6)
Loss of hairs over patches	8	5(62.5)
White hairs over patches	21	8(33.3)
New eruptions over patches	11	4(36.3)
Itching	15	8(53.3)
Burning	10	6(60)
Photosensitivity	10	7(70)

The above observation and results shows that the drug seems to have irritant, corrosive, antivitiligo, blood purifier and anti-phlegm effect. (Nandkarni, 2000; Ali SS, 1999). During the study no adverse effect(s) were noted clinically. Liver function test and renal function test were done before and after treatment and the results show that there is no adverse effect of drug on liver and kidneys. The study has concluded that the single Unani drug Babchi (*Psoralea corylifolia* Linn.) is effective and safe in cases of Bars (Vitiligo).

Acknowledgements

The authors are thankful to the Department of Moalejat of A.M.U Aligarh for providing all the facilities to carry out the study.

References

Ali, Sayed Safiuddin, 1999. Unani Advia-e-Mufreda, 8th ed. Qaumi Council Bara-e-Farogh Urdu Zaban, New Delhi, p. 59

Arnold, Harry L., 1990. Andrew's Diseases of Skin. B Saunders Company Ltd. London, pp.11-17

Champion, R.H *et al*., 1998. Text Book of Dermatology, Vol.--II, 6th ed. Blackwell Science Publication, USA, pp. 113-122, 1802-1809

Cohen, Bernard A, *et al.* 1999, Pediatric Dermatology, 2nd ed. Mosby Pub., London, pp. 146-147 Ibn-Sina, Bu Ali Shaikh-ur-Rais, 1906. Al-Qanoon Fi Tibb – Translation in Urdu by Hakim Ghulam Hussain Kantoori, Matba'a Munshi Nawal Kishore, Lucknow, pp. 389-395

Khan, Ajmal, Ynm. Hazique, Beesween Sadi Book Depot, N.S. Marg, New Delhi, pp. 546-547.

Majoosi, Ibn-al-Abbas, 1989. Kamil-us-Sana'a, Urdu translation, Vol.-1. Munshi Nawal Kishore Press, Lucknow, p. 196

Nandkarni, K.M., 2000. Indian Materia Medica, Vol 2. Popular Prakashan, Bombay, pp. 1019-1021

Razi, Abu Bakar Mohd. Bin Zakariya, 1970. Kitab-Al-Hawi Fit Tibb, 1st ed. Vol.-- XXIII, Dairatul Moarif, Osmania University, Hyderabad, pp. 72-75

Valia, R.G., 2001. IAVDL Text Book and Atlas of Dermatology, Vol.--I, 2nd ed. Bhalani Publishing House, Mumbai, pp. 173-184.

Randomized Clinical Trial of Unani Formulations in Chloasma/ Melasma

Abdul Latif*, Niam Zafar and Abdullah

Extra Mural Research (EMR) Project,
Department of Ilmul Advia,
A.K. Tibbiya College,
Aligarh Muslim University,
Aligarh – 202002, U.P., India

Abstract

Hyperpigmentation is defined as predominance of black-bile (ghalba e sauda) in skin or in blood, in the Unani system of medicine. The various hyperpigmentation conditions are kalaf, namash, barash, also known by the names of jhaeen, nuktay, lehsun, etc. The hyperpigmentation itself is not a disease but a manifestation that creates a condition of concern and stress for the patient. Melasma is a common acquired symmetric hypermelanosis which is characterized by the presence of light brown-to- dark brown-to –black macules and patches mostly on the sun exposed areas of skin of the face. There are multiple etiologic factors associated with melasma (pregnancy, inflammatory, racial, endocrinal, photo toxicity, photosesnsitivity of drugs and food) but one of the primary causes of its exacerbation is exposure to sunlight. The purpose of this study is to ascertain and assess the efficacy and safety of treatment with Unani formulations in participants with moderate to severe melasma. The study design is Randomized, Single blind Controlled Clinical trial. The control group received oral plus topical treatment with Unani formulations coded as MN and XM, respectively.

Key Words: Melasma/Chloasma, Hyper pigmentation, Inflammatory, Unani formulations.

Introduction

Melasma also known as *chloasma,* appears as a blotchy, brownish pigmentation on the face that develops slowly. The pigmentation is due to overproduction of melanin by the pigment cells, melanocytes (Pandya *et al*., 2007). In the Unani System of Medicine, the hyperpigmentation or melasma is defined as the *ghalba sauda* i.e. imbalance (predominance) of the humor called black bile or *sauda* in the blood and or skin (Azhar, 2002; Cochran and Cox, 1992; Ruxton and Colegrave, 2006). The objective of this study is to conduct a clinical trial to assess the safety and efficacy of Unani formulations as a combination therapy comprising MN (oral) and XM (topical) in the treatment of chloasma/ melasma and also to assess ADR/side effect/toxicity of Unani Dermatological drugs used in this clinical study.

Causes of Chloasma/Melasma

Pregnancy – the pigment often fades a few months after delivery (Bhutani,

* Author for correspondence

2009).Hormonal contraceptives, including oral contraceptive pills and injected progesterone, genetic predisposition, sun exposure (Khanna, 2009). Scented or deodorant soaps, toiletries and cosmetics – a phototoxic reaction, unknown factors, when it arises in apparently healthy, normal, non-pregnant women (Pandya *et al*., 2007).

Female sex hormones estrogen and progesterone stimulate melanocytes to produce more melanin when the skin is exposed to sunlight. Several hormones influence melanogenesis and the most important being melanocyte stimulating hormone secreted by the pituitary gland (Khanna, 2009).

Clinical features

Melasma affects the forehead, cheeks and upper lips resulting in macules (freckle-like spots) and larger patches. Occasionally it spreads to involve the sides of the neck, and a similar condition may affect the shoulders and upper arms. Melasma is divided into epidermal (skin surface), dermal (deeper) and mixed types.

Centro facial: affecting forehead, cheeks, nose, chin and skin above upper lip. Mandibular type: ramus mandibularis is involved. Cheek type (Malar type): affecting cheek and nose closely. The other symptom of melasma pigmentation is that it darkens on sun exposure (Khanna, 2009).

The eyelids and central part of the upper lip however, are never involved (Pasricha & Ramji, 2006).

Histological difference

Melanin is increased in the epidermis, in the dermis, or (most commonly) in both locations in melasma patients (Khanna, 2009)

Epidermal: Epidermal melanin is found in Keratinocytes in basal and suprabasal area. Sometimes melanocytes do not increase in number. But are larger, more dendritic and more active.

Dermal: Dermal melanin is found in superficial and mid dermis within macrophagus which often congregate around small, dilated vessels. Inflammation sparse or absent.

Methods

Selection criteria (Inclusion Criteria)

1. Individuals with moderate to severe melasma.

2. All patients with hyper pigmentation of skin.

3. Age: 15 – 60 years, both gender (male & female)

Exclusion criteria: Diabetes mellitus, Hepatic or Renal damage, Tuberculosis, Cancer, Drug & Alcohol abused and Pregnancy.

Study Design: Randomised single blind study

Forty two individuals were randomly selected and then underwent a combination therapy of Unani formulations for oral and local use for the treatment of melasma.

The combination therapy for Group A, comprised of the formulations, coded MN (*Majoon*) for oral use, 10gms twice a day and XM (Powder) for local application as paste in rose water, twice a day for 30 minutes before washing off with water. While Group B (placebo group) received placebo of *Majoon* MP, orally 10 gms twice a day and XP Powder as paste in water, twice a day for local application.

Randomisation was done using Random Number Generator, so as to remove bias in patient allotment in each group.

The diagnosis and type of melasma was determined by Wood's Lamp examination (Ruxton and Colegrave, 2006).

Complete haemogram (Hb%, TLC, DLC & ESR), Liver Function Test (Total, direct and indirect bilirubin, SGOT, SGPT and Serum Alkaline Phosphatase) and Kidney Function Test (Blood urea and serum creatinine) were performed initially and two more samples were taken at every 45 days to check and assess the toxicity and ADR.

Hyper pigmented spots were evaluated at every 4 weeks interval for a period of 12 weeks.

Outcome measures included physicians' global assessment a MASI Scoring, subjective evaluation of melasma patch (Pandya *et al*., 2007).

The MASI (Melasma Area and Severity Index) is an index devised to more accurately quantify the severity of melasma and changes during therapy. The MASI is calculated based on the area (A) of involvement, the darkness (D) of melasma, and the homogeneity (H) of the hyperpigmentation. The forehead (F), right malar (RM), left malar (LM) and chin (C) correspond to 30%, 30%, 30% and

10% of the total face, respectively, giving a total facial surface area of 100%.

The area of involvement (A) in each of these areas is given a numerical value of 0 to 6:

0 – *indicates no involvement*; 1, *0% - 9%*; 2, *10% - 29%*; 3, *30%- 49%*; 4, *50%- 69%*; 5, *70%- 89%*; and 6, *90%- 100%.*

The severity of melasma is also determined by measuring two additional variables: darkness (D) and homogeneity (H), rated on a scale from 1 to 4:

0 – *indicates absent*; 1 *slight*; 2 *mild*; 3 *marked*; and 4 *maximum*.

The MASI score is calculated by adding the sum of the severity ratings for darkness and homogeneity, multiplied by the value of the area of involvement, for each of four facial areas. The values for each side are then totalled. The maximum score for each side is 24 and minimum is 0. The readings were taken at baseline, weeks 4, 8 and 12.

Observations

It was observed that the incidence of this disease is highest in the age group of 21- 30 years (50%) and least common in the age group of 51- 60 years, (3%). In our study the ratio of females (64%) is higher than the males (36%) (Table 1, Fig 1 & 2).

Table 1: Sex and age-wise distribution in the cases of melasma/chloasma

AGE GROUP	MALE	FEMALE	TOTAL	%
15 - 20 yrs	4	7	11	26%
21- 30	8	13	21	50%
31- 40	1	5	6	14%
41- 50	1	2	3	7%
51- 60	1	--	1	3%
Total	15	27	42	100%

The incidence of melasma was found to be more common in the middle income group, 81% and in the low income group the incidence was 19% (Fig. 3).

This condition was found to be quite common among the students (41%) and housewives (24%) (Fig. 4).

57% participants took mixed diet i.e. vegetables and animal products. 38% participants took purely vegetarian diet and those who were purely non-vegetarians were only 5% (Fig. 5).

Fig. 1 Age wise distribution

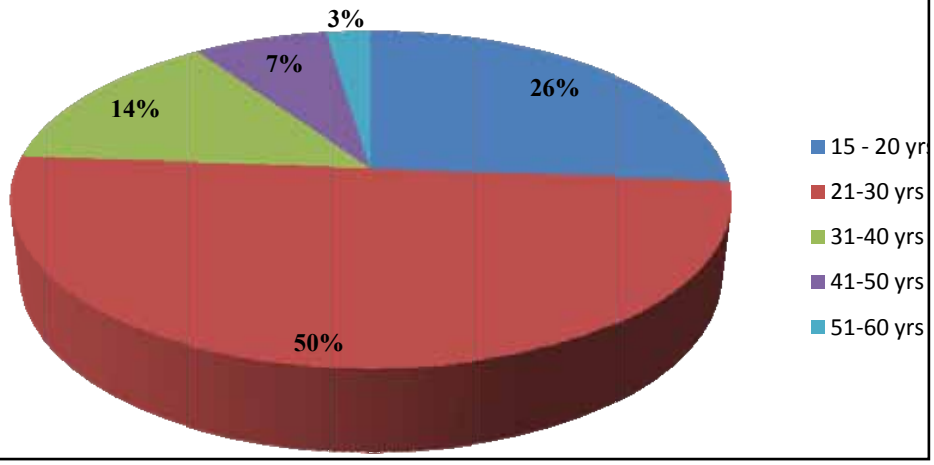


Fig. 2 Sex wise distribution

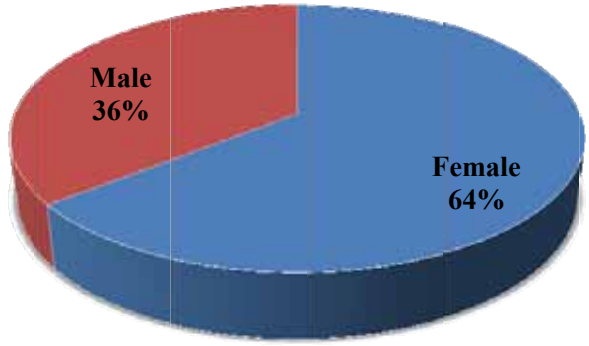
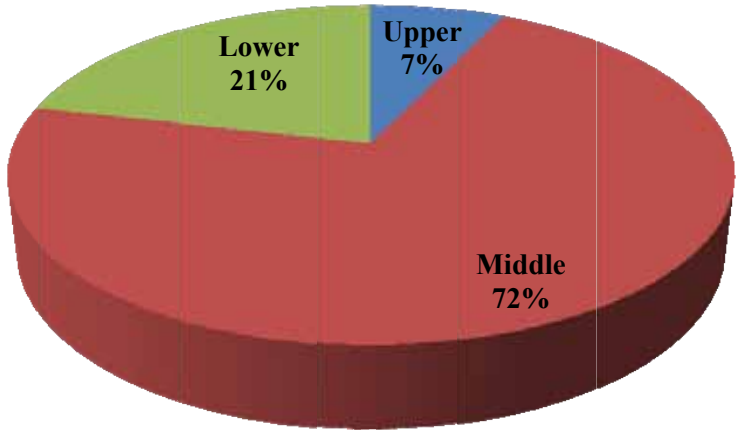


Fig. 3 Socio- economic status



It was found that the common type of melasma is the epidermal melasma (57%), followed by the dermal type (31%) and then mixed type of the melasma (12%) in the 42 participants (Fig. 6).

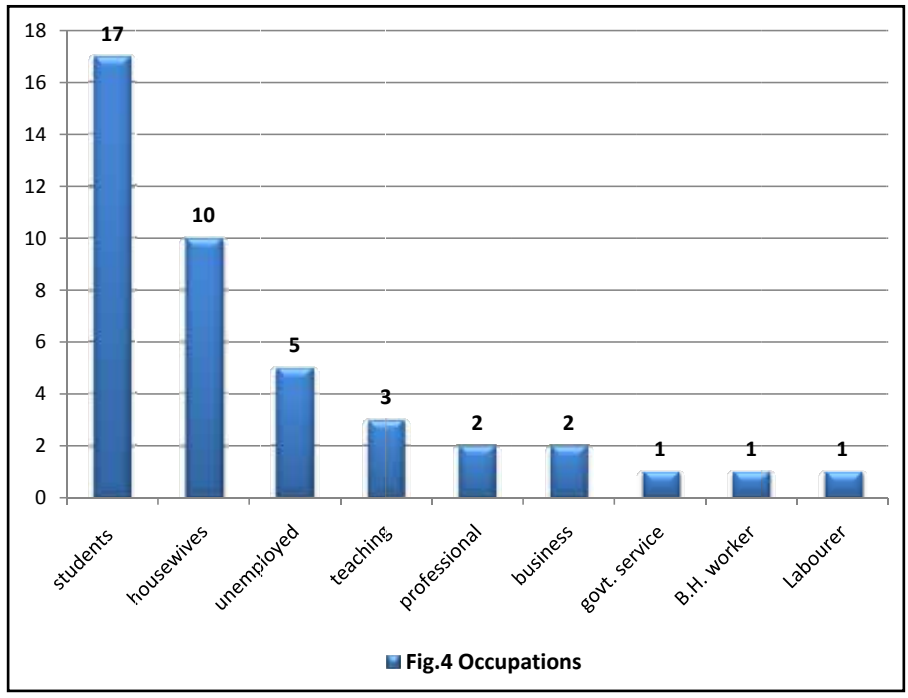


Fig. 5 Dietary habit

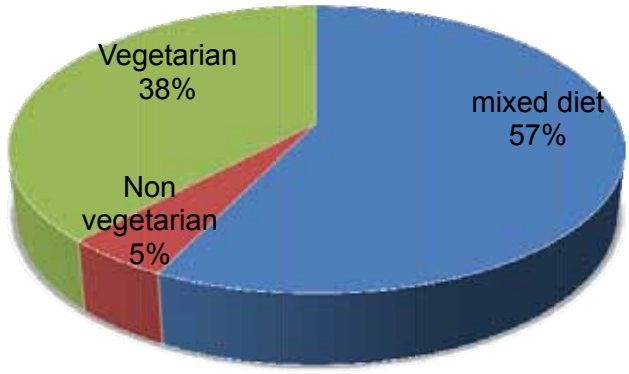
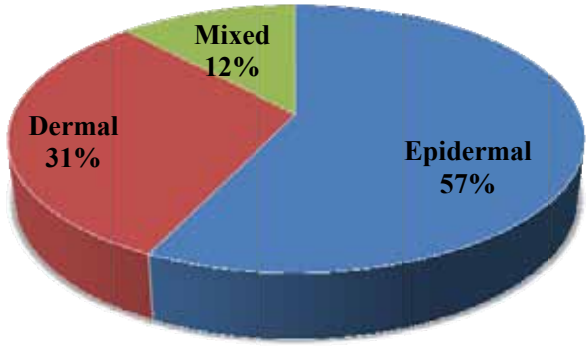
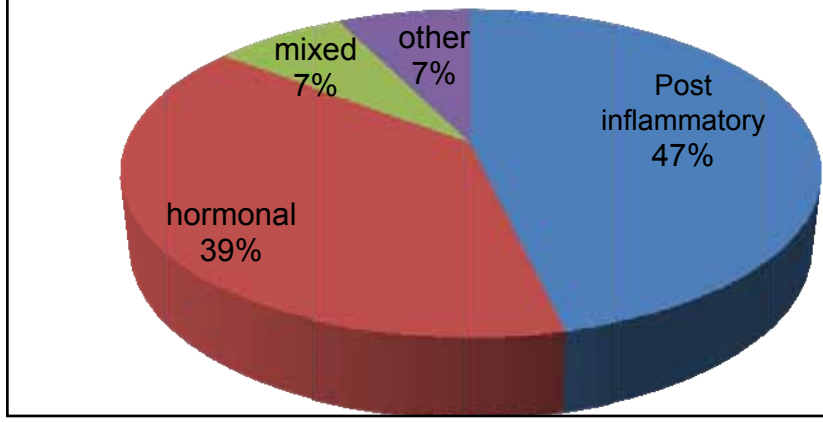


Fig . 6 Type of Melasma in all the patients



The melasma due to inflammation seems to be most common cause of epidermal (12), dermal (5) and mixed (3) type of melasma in 20 participants. The melasma due to hormonal influence were seen in 16 participants (epidermal in 12, dermal in 3 and mixed in 1 participant). Mixed causes i.e. both inflammatory and hormonal were seen in a single participant affected with mixed melasma and 2 participants of dermal melasma. The other causes of melasma were seen in 3 participants with dermal melasma- (Fig 7& 8).

Fig. 7 Cause of hyperpigmentation



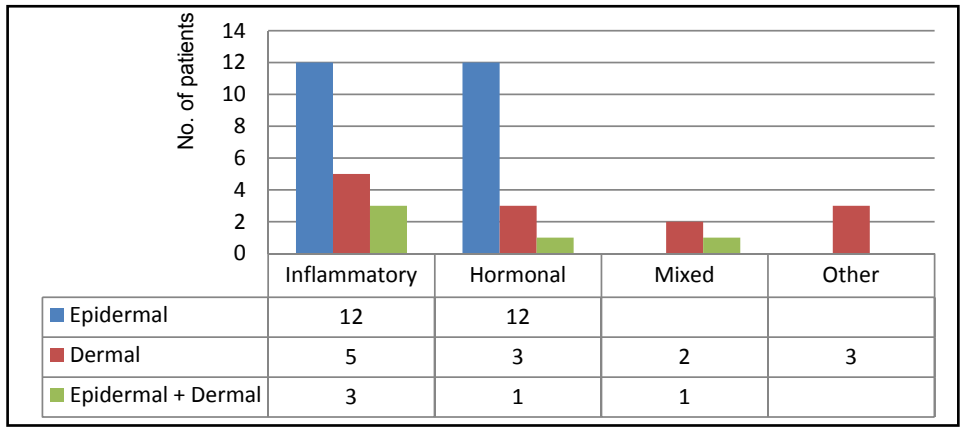


Fig. 8: Type of hyperpigmentation according to cause

The investigations like complete haemogram with ESR, Liver F.T. and Renal F.T. were performed in every patient of each group and was found to be within normal limits (Table 5).

Results

The group that received combination therapy demonstrated significant improvement in the subjective evaluation of melasma. The response of the combination therapy was found excellent (19%) in four patients, good (38%) in eight patients, and satisfactory (33.5%) in seven patients, slow (9.5%) in two patients and there was not a single patient who showed no response (Table.2 & Fig. 9).

Table 2: Showing the response of treatment in the Group A and B

Improvement	Total improvement		Partial improvement		Failure	Total Therapeutic Response
Response	Excellent (80-100%)	Good (70%)	Satisfactory (30%)	Slow (15%)	No Response (0%)	
Group A (Intervention)	19%	38%	33.5%	9.5%	0%	100%
No. of patients	4	8	7	2	-	21
Group B (Placebo)	0	0	9.5%	28.6%	61.9%	100%
No. of patients	0	0	2	6	13	21

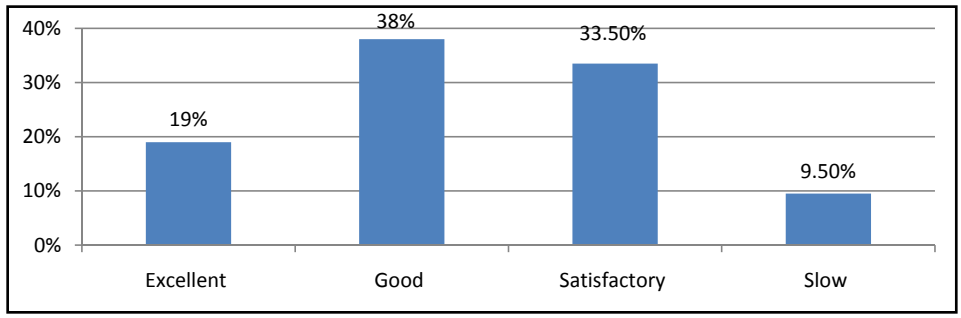


Fig. 9: Showing response in Group A

The patients of placebo group showed no response in 61.9% cases. Satisfactory response was seen in only 9.5 % cases and slow response was seen in 28.6% cases (Table 2, Fig. 10).

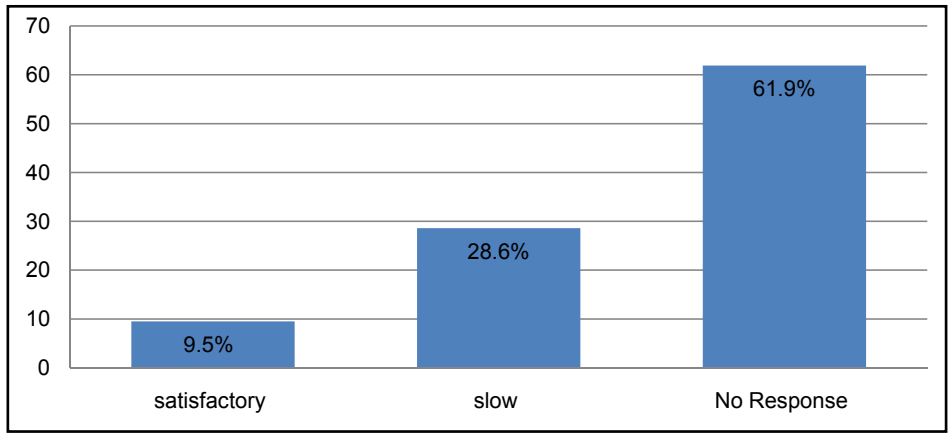


Fig. 10: Graphical representation of response in group B (Placebo)

In Intervention Group (A) the Total improvement of about 57 % was seen in 12 patients and Partial improvement of 43% was seen in 9 patients out of 21 patients at 12 weeks. Failure to treatment was not seen. In the Group B (placebo), only Partial improvement of about 38.1% was seen in about 8 patients out of the 21 patients. Failure rate of about 61.9% in the 13 patients was noted in this group at 12 weeks (Table 3).

Table 3: Showing Total improvement Vs. Partial improvement Vs. Failure in patients of Group A and B.

Group	Total improvement	Partial improvement	Failure
A (Intervention)	57%	43%	0%
No. of patients	12	9	-
B (Placebo)	0%	38.1%	61.9 %
No. of patients	-	8	13

Epidermal melasma showed response in a total of 53% subjects with 4 cases getting 70% relieve and 3 cases getting more than 80 % cured. Dermal melasma showed response in 33% cases. Mixed type of melasma showed response in 14 % cases of group A (Table 4 & Fig.11).

Table 4: Relation of response with type of melasma in Group A

Type	15% Slow	30% Partially relieved	Up to 70% Relieved	80—100% Cured	Total (n= 21)
Epidermal	1	2	4	3	11 (53%)
Dermal	1	3	3	1	7 (33%)
Mixed	0	2	1	0	3 (14%)

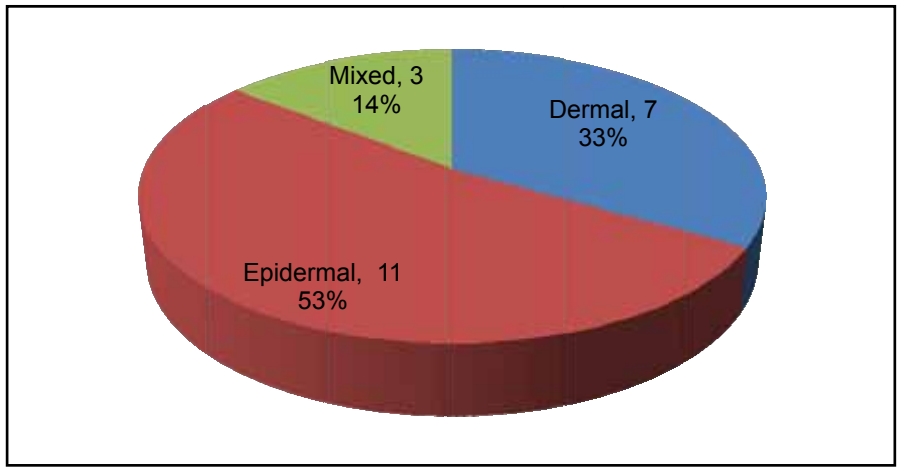


Fig. 11: Type of Melasma in Group A

The mean MASI score of Group A (Drug) at Baseline was 8.34 which decreased considerably to 3.22 at 12th week but in the Group B (Placebo) the mean MASI score at baseline was 6.07 which only came down to 5.26 at the 12th week (Fig 12).

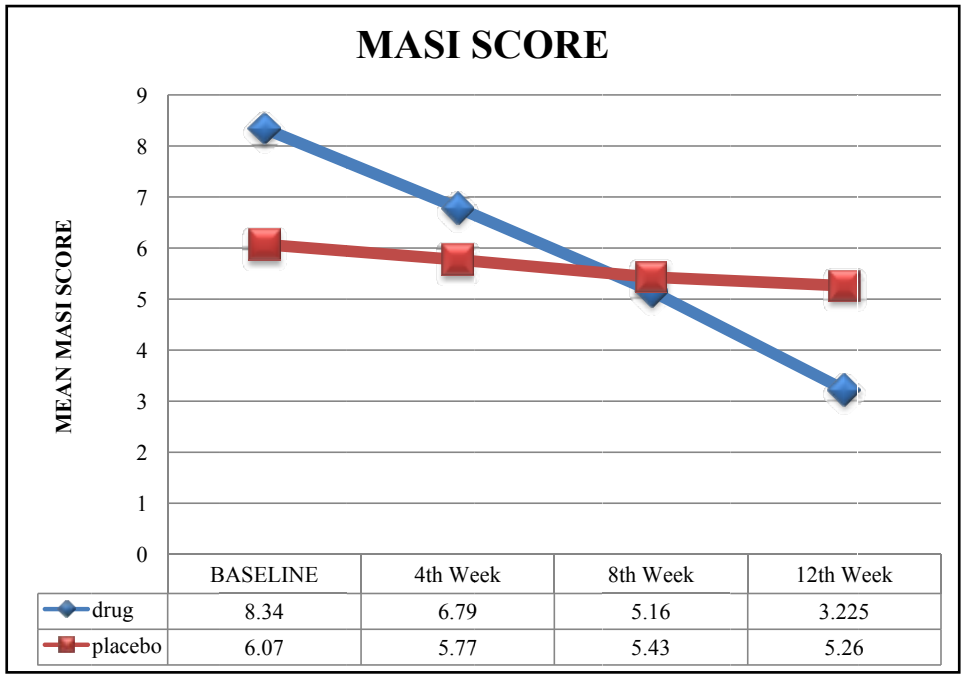


Fig. 12: Mean MASI score at baseline, 4th week, 8th and 12th week in Group A and Group B

Discussion

The response of combination therapy of *Majoon* MN and powder XM was found excellent in 19% cases, good in 38% cases, satisfactory in 33.5% cases and slow in 9.5% cases. The total therapeutic response achieved was 100%.

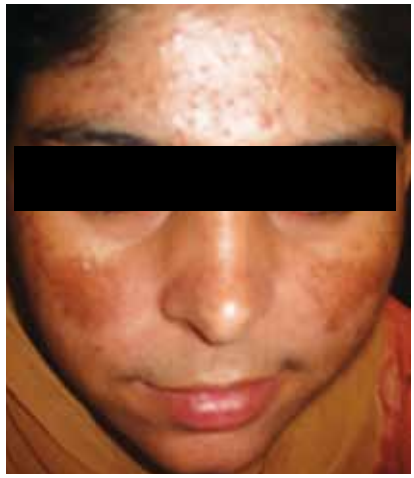
It has been clearly observed that this combination therapy showed good and excellent results in cases of epidermal type of melasma related with inflammatory causes. A partial improvement of 38.1% and no response of 61.9% was seen in group B that received Placebo.

It may be assumed that in melasma due to inflammatory causes, the accumulated melanin in exposed part of the skin get easily dissolved or disintegrated. It is to be further seen that whether the melanocytes decrease in number or in size.

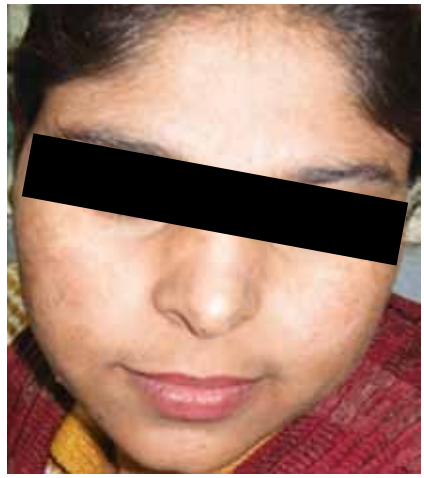
No side effect was seen in any case of melasma.

Table 5: ESR, LFT, RFT etc. Tests in patients

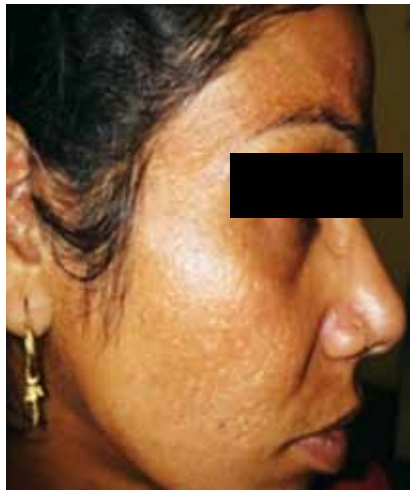
GROUP	TEST I	TEST II	TEST III
Group "A" (Intervention)	Within normal limits	WNL	WNL
Group "B" (Placebo)	Within normal limits	WNL	WNL

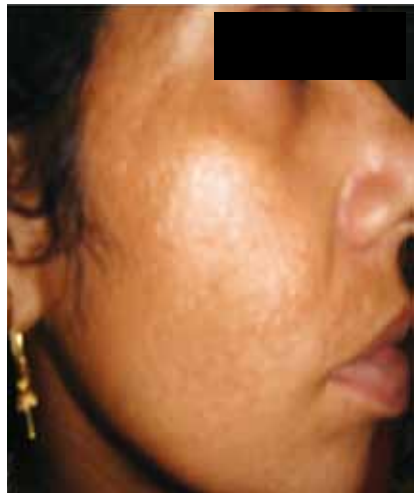


Before Treatment



After Treatment





Before Treatment

After Treatment

Fig. 13: Photographs of Patients

Conclusion

This Unani Herbal formulation, a combination therapy of majoon (MN) for oral use and powder (XM) for topical application has showed significant efficacy in melasma cases showing a positive trend, and thus provides vital information for follow-up future research.

Acknowledgement

We are thankful to Central Council for Research in Unani Medicine, Department of AYUSH, Ministry of Health and Family Welfare, Govt. of India, New Delhi for funding this EMR project.

References

Azhar Hasan Mohammad Yasin (Hkm), 2002. Amraz-e-jild. Danish Offset Printing Press, Mohammadiya Tibbiya College, Mansurah, Malegaon, Maharashtra, pp. 34-37

Bhutani, L.K., 2009. Colour Atlas of Dermatology. Mehta Publishers, Fifth Edition, p. 151.

Cochran, W.G. and Cox, G.M., 1992. Experimental Designs (2nd Edition). John Wiley & Sons, New York.

Kabeeruddin (Hkm)., 1956. Tarjuma Kabeer (Moalejat Shar-e-asbab). Hikmat Book Depot, Hyderabad, Vol.IV, pp. 450-451.

Khanna, N., 2009. Illustrated Synopsis of Dermatology & Sexually Transmitted Diseases. Elsevier, 3rd edition, p. 125-127.

Lancaster G.A., Dodd, S. & Williamson, P.R., 2004. Design and analysis of pilot studies: Recommendations for good practice. *Journal of Evaluation in Clinical Practice* 10(2): 307-12

Pandya, A.M., Berneburg, J.P. Ortonne, M. Picardo, 2007. Guidelines for Clinical Trial in Melasma. *British Journal of Dermatology* 157(1): 21-28.

Pasricha, J.S., Ramji Gupta, 2006. Illustrated Textbook of Dermatology, Jaypee Brothers Medical Publishers (P) Ltd. India, 3rd Edition, p. 115.

Rajaratnam, R., Halpern, J, Salim A, Emmet, C, 2010. Interventions for melasma (Review), The Cochrane Collaboration, John Wiley & Sons, Ltd, pp.1-4.

Ruxton, G.D. and Colegrave, N., 2006. Experimental Design for the Life Sciences, 2nd edition. Oxford University Press, Oxford.

Steroidal and Metabolic Effect of *Kaknaj* (*Physalis alkekengi* Linn)

[1]Ghufran Ahmad*, [2]Wasim Ahmad, [1]N.A. Khan and [3]Shamshad Ahmad

[1]Department of Ilmul Advia, A.K. Tibbiya College, Aligarh Muslim University, Aligarh-202002, India

[2] Department of Ilmul Advia, Mohammadia Tibbia College, Malegaon, Mansoora, Nashik-423203 (Maharashtra), India

[3]Department of Pathology, J.N. Medical College, Aligarh Muslim University, Aligarh-202002, India

Abstract

In the present study the hydroalcoholic extract of fruits of *Physalis alkekengi* was investigated for its steroidal and metabolic activity in albino rats of either sex in two different tests. In both the tests, the animals were treated with the test drug (450 mg/kg/p.o.) twice a day for three days and were sacrificed subsequently on day 4. In the test for steroidal activity, thymus gland was dissected out and weighed while in the test designed for metabolic activity, liver was dissected out for glycogen estimation and blood was collected for the estimation of blood sugar, serum protein and serum cholesterol. The test drug reduced the thymus weight significantly ($p<0.01$) as compared to the plain control. It also induced hyperproteinemic and liver glycogen increasing effect and moderately increased the blood glucose level. The findings suggest that the hydroalcoholic extract of fruits of *Physalis alkekengi* possesses marked steroidal and metabolic activity. Steroidal effect may be one of the bases for its use in kidney diseases especially nephrotic syndrome like condition.

***Keywords*:** Steroidal activity, Metabolic activity, *Physalis alkekengi*, Unani Medicine.

Introduction

The fruit of *Physalis alkekengi*, Linn (Fam. Solanaceae) commonly known as *Kaknaj* is in use in Unani Medicine (*Tibb-e-Unani*) since ancient times to ameliorate various renal diseases (Ghani 1920; Aawan, 1993; Aziz, 1948). It's attributed effects in Unani literature such as anti-inflammatory, diuretic, nephroprotective and tonic to kidney etc are considered instrumental for its efficacy in various renal diseases (Aawan, 1993; Ghani 1920; Aziz, 1948; Dymock, 1891; Nadkarni, 2000; Chopra *et al*., 1956; Trease and Evan, 2002). An injury caused by mechanical or chemical stimuli to the kidneys and the urinary tract are also described to be brought about by its oral administration (Ibn Sina, 1906). Ethnobotanical reports suggest almost similar effects and indicate its therapeutic application in different kidney diseases such as kidney failure, stones; injury to kidney and bladder etc and also to protect the kidney from chemical and physical stimuli (Anonymous, 1996; Dymock, 1891). In a recent study it has been shown to possess significant nephroprotective effect against gentamicin induced nephrotoxicity in experimental animals. It also improved a condition which was simulating with the symptoms of nephrotic syndrome (Wasim et al., 2010). It was hypothesized therefore that

*Author for correspondence

the steroidal effect (immunological/anti-inflammatory) may be one of the reasons for its efficacy in such a condition. Therefore the hydroalcoholic extract of *Kaknaj* (30:70) was studied for steroidal effect by Thymus Regression Test (Stephenson, 1954). Further since the steroidal agents induce certain metabolic effects therefore metabolic activity was also studied by observing its effect on liver glycogen, serum glucose, serum protein and serum cholesterol levels.

Materials and methods

Preparation of ethanol extract

The fruits of *Physalis alkekengi,* Linn were procured from Dawakhana Tibbiya College, Aligarh Muslim University (AMU), Aligarh, India. Prof S.H. Afaq and Dr. M. Inamuddin (Pharmacognosists), Department of Ilmul Advia, Faculty of Unani Medicine, AMU, Aligarh confirmed the identity of the drug. A voucher specimen (No. WA/2005/3) has been deposited in the museum of the department of Ilmul Advia, Faculty of Unani Medicine, AMU, Aligarh, India for future reference.

The fruits were dried at room temperature and reduced to coarse powder by grinding. Powdered drug was macerated in 70% ethanol and left for 12 h at room temperature. It was then extracted for 6 h in a Soxhlet apparatus at 82± 2 ^{0}C. 100 g of powder was extracted in 400 ml of solvent. The extract was filtered using Whatman filter paper and the filtrate was concentrated over a water bath. The yield of the extract was found to be 30% of crude drug (w/w). The extract was reconstituted a fresh in distilled water whenever it was intended to be administrated to the animals.

Experimental Animals

Wistar Albino rats of either sex weighing 40-50 g (Thymus regression test) and 100-150 g (Metabolic test), divided into three groups of six animals each were used. They were maintained on standard diet and water *ad libitum* and housed in clean polypropylene cages at room temperature (25-30 ^{o}C) with a 12 h light: 12 h dark cycle.

Treatment Schedule

The dose of *Kaknaj* for albino rats was calculated by multiplying the human therapeutic dose, described and practiced in Unani Medicine (Ghani, 1920; Husain, 1872; Nabi, 1901; Singh, 1974) by conversion factor of 7 (Freidrich et al., 1966). The dose thus calculated was found to be 450 mg/kg. The test drug

suspended in distilled water was administered to the animals intragastrically with the help of a gastric canula twice a day.

Test for steroidal activity

The test drug was studied for steroidal effect by the method of Stephenson (1954) and Amin *et al*. (1994).

Albino rats of either sex, weighing 40-50 gm were divided into 3 groups of 6 animals each having equal distribution of sexes and such that the total weight of animals in various groups were approximately the same. The animals in Group I served as plain control and received 3 ml of distilled water by oral route, twice a day, for 3 days. The animals in Group II serving as standard control were treated with Hydrocortisone 33.33 microgram/100 g, twice a day, for 3 days, by subcutaneous injection. While the animals in Group III were treated with the hydroalcoholic extract of fruits of *Kaknaj* at a dose of 450 mg/kg, twice a day, for 3 days, by oral route and served as test group. The concentrated extract was reconstituted in suspension form with distilled water (450 mg/3 ml, w/v) and 2% gum acacia, before the administration.

On the 4th day all the animals were sacrificed by overdosing of anaesthetic ether, administered by inhalation and the thymus gland was dissected out. The body weight and the weight of the thymus gland were recorded. The results were expressed as mg of thymus gland/100 gm of body weight.

Test for metabolic activity

The metabolic effect of the test drug was studied on liver glycogen by the method of Montgomery (1957), serum glucose by the method of Hultman (1959), serum protein by the method of Dumas (1971) and serum cholesterol by the method of Wybenga (1974) in albino rats.

Albino rats of either sex, weighing 100-150 gm were divided into 3 groups of 6 animals and treated in the same way as in the previous test. On the 4th day all the animals were sacrificed by overdosing of anaesthetic ether, administered by inhalation, and blood sample was collected by cutting the throat for the estimation of blood sugar, serum protein and serum cholesterol, while the liver was dissected out for glycogen estimation.

2.4. Statistical Analysis

The results were given as mean ± S.E.M. Significance was determined by using the Student's '*t*' test. *P*-value equal to or less than 0.05 showed significance.

Results

Steroidal effect

In plain control group the mean thymus weight was found to be 231.40 ± 0.314 mg/100 gm of body weight while in the standard group treated with hydrocortisone, 33.33 µg/100 g, it decreased to 146.54±0.355 mg/100 gm of body weight ($p<0.001$). The weight of thymus gland in the animals treated with the extract of fruit of *Physalis alkekengi,* Linn (*Kaknaj*) was found to be 178.34±0.310 mg/100 gm ($p<0.01$). The results are presented in Table-1.

Table-1. Effect of *Kaknaj* on the weight of thymus gland

Groups	Thymus Weight (mg/100 gm) (Mean±S.E.M.)
Group I (plain control)	231.40 ± 0.314
Group II (standard control)	146.54 ± 0.355a3
Group III (test group)	178.34 ± 0.310a1b1

n = 6

a = against plain control b = against standard control

1 = $p < 0.05$ 2 = $p < 0.01$ 3 = $p < 0.001$

Metabolic effect

Effect of test drug on liver glycogen

The liver glycogen was found to be 14.12±0.43 mg/gm in plain control group while it increased to 28.89±0.23 mg/gm ($p<0.001$) in the standard group treated with hydrocortisone, 33.33 µg/100 gm of body weight. In the animals treated with the test drug it increased to 20.14±0.62 mg/gm ($p<0.01$).

Effect of test drug on serum glucose

Serum glucose was found to be 76.32±0.45 mg/dl in the plain control group. It increased to 114.74±0.86 mg/dl ($p<0.001$) and 90.38±0.32 mg/dl ($p<0.05$) in standard and test groups, respectively. Glucose level was significantly lower ($p<0.01$) in test group as compared to standard group.

Effect of test drug on serum protein

Serum protein was found to be 5.74±0.49 gm/100 ml of serum in plain control group while in hydrocortisone treated group it amounted to 9.76±0.79 gm/100

ml of serum ($p<0.01$). In the animals treated with the extract of test drug, it was found to be 6.53±0.62 gm/100 ml of serum showing a significant increase as compared to plain control ($p<0.05$).

Effect of test drug on serum cholesterol

Serum cholesterol was found to be 173.54±0.52 mg/dl in plain control group. It increased to 201.33±0.42 mg/dl ($p<0.05$) in hydrocortisone treated group. However it decreased slightly to 169.66±0.48 mg/dl in the group treated with the test drug but was not found significant statistically. The results of metabolic effects are presented in Table-2.

Table-2. Effect of fruit of *Kaknaj* on metabolic parameters

Groups	Liver Glycogen (mg/gm) (Mean ± S.E.M.)	S. Glucose (mg/dl) (Mean ± S.E.M.)	S. Protein (g/100 ml) (Mean ± S.E.M.)	S. Cholesterol (mg/dl) (Mean ± S.E.M.)
Group I (Plain control)	14.12±0.43	76.32±0.45	5.74±0.49	173.54±2.52
Group II (standard control)	28.89±0.23a3	114.74±0.86a2	9.76±0.79a2	201.33±0242a1
Group III (test drug)	20.14±0.62a2b1	90.38±0.32a1b2	6.53±0.62a1b2	169.66±1.48b1

N = 6

a = against plain control b = against standard control

1 = $p<0.05$ 2 = $p<0.01$ 3 = $p<0.001$

Discussion

The study reveals that the test drug *Physalis alkekengi* possesses significant steroidal activity. It was found to reduce the thymus weight to an extent which was only moderately lesser than the regression produced by hydrocortisone (Table.1). The thymolytic activity of hydrocortisone and its analogues particularly in immature animals is well documented (Stephenson, 1960). In an *in vitro* study it has been shown that basophilic cells normally found in 12 and 13-day embryonic thymus glands disappeared after steroid treatment (Younan, 1968). Thymus regression effect of steroids was also evident from the findings of the present study where the weight of thymus gland was found to be decreased significantly ($p<0.001$) under the influence of hydrocortisone.

Similarly, the test drug by decreasing the weight of thymus gland significantly ($p<0.01$) indicated having thymolytic and thereby steroidal effect. Since, the steroids have an immunosuppressant effect, which is the basis of their therapeutic application in nephrotic syndrome therefore the efficacy of test drug in nephrotic syndrome like condition for which it has been recommended in Unani literature and validated in an experimental study (Wasim et al., 2010), may be attributed at least partially to its steroidal effect. This finding is also suggestive of its potential to alleviate other diseases where steroids may have a role. Other effects reported to the test drug such as diuretic (Wasim et al., 2005) and anti inflammatory (Kang et al., 2011) etc may have a direct bearing on nephrotic syndrome and related conditions and/or act as adjuvant to the principal drug. It is interesting to mention that steroids in addition to their immunosuppressive effect also possess anti-inflammatory effect and may modify the body's immune response to diverse stimuli (Waldman et al., 2007). Thus the combined nephroprotective, anti inflammatory, diuretic and steroid like effect the test drug is attributed with, appears to be in direct commensuration with the physiopathology of nephrotic syndrome. The findings are also suggestive that the diseases with diverse physiopathological appearance can be treated even with a single drug of Unani medicine because they commonly have multiple and related, even synergistic effects. This is one of the many advantages that crude drugs have over the isolated compounds.

Steroidal agents play important part in controlling salt and water balance in the body, and regulating carbohydrate, fat, and protein metabolism. They are responsible for certain metabolic effects although when they are used in immunosuppressive and anti-inflammatory therapy their metabolic and other effects are taken as unwanted side effect (Rhen and Cidlowski, 2005). Therefore, different metabolic effects induced by the steroids are mostly not desirable therapeutically. The present study showed that the test drug has significant hyperproteinaemic and liver glycogen increasing effects. It also produced moderate hyperglycaemia which was significantly less than the findings of standard group, but did not alter the cholesterol level. These findings are more or less in consonance with steroidal activity (Stephenson, 1960). Thus the metabolic effects produced by *Physalis alkekengi* further confirmed that it possessed steroidal effect. Hyperglycaemia and hyperchesterolaemia are not desirable effects of steroids at all whereas hyperproteinemic and glycogenic effects at occasions are used therapeutically. By demonstrating moderate effect on glucose level and not modifying the cholesterol level, the test drug exhibited that it has relatively lesser chances of producing unwanted side effects and is therefore safer than the common

steroidal agents. Although, Tang et al (2008) have reported hypoglycaemic effect in *Physalis alkekengi* but they have studied one of its isolated polysaccharides not the whole drug or its extract, and such a difference in the efficacy of whole drug and its fractionated part is not uncommon.

Thus, the findings of the present study have shown that the fruit of *Physalis alkekengi* possesses marked steroidal and metabolic activity. The steroidal effect may be the basis of its wide therapeutic application in various renal disorders including nephrotic syndrome like condition as described by Unani physicians. It has a definite edge over the pure steroids on account of having minimum chances of producing side effects that are common to the steroidal drugs.

Acknowledgements

We thank Prof. S.H. Afaq and Dr. M. Inamuddin (Pharmacognosists), Department of Ilmul Advia, Faculty of Unan medicine, Aligarh Muslim University, Aligarh who undertaken the necessary pharmacognostical studies to confirm the identity of the test drug. We are also grateful to Prof. K.M.Y. Amin (Pharmacologist) of the same department for guiding us to formulate the study design.

References

Aawan, M.H., 1993. Kitabul Mufradat Al-Maroof Ba Khawasul Advia Batarz-e-Jadeed, published by Shaikh Ghulam Ali & Sons (Pvt.) Ltd., Lahore, p. 341.

Amin, K.M.Y., Ahmad, S., Khan, N.A., 1994. Antinephrotic syndrome effect of ethno drug *Bisehri Booti* (*Aerva lanata*) – an experimental study of relevant pharmacological actions, Abstract Book, Fourth International Congress on Ethnobiology, NBRI, Lucknow, November 1994, p. 94.

Anonymous, 1996. The Encyclopaedia of Medicinal Plants, published by Dorling Kindersley Ltd., Great Britain, p. 245.

Aziz, M.A., 1948. Mufradat-e-Azizi, published by Sahitya Mandir Press Ltd. Lucknow, p. 47

Chopra, R.N., Nayar, S.L., Chopra, I.C., 1956. Glossary of Indian Medicinal Plants, National Institute of Science Communication and Information Resources, Council of Scientific and Industrial Research, New Delhi, p.191.

Dumas et al., 1971.Clinical Chemistry *Acta*, 31: 87-96

Dymock, W., Warden, C.J.H., Hooper, D. 1891. Pharmacographia India – A History of the Principal Drugs. The Institute of Health and Tibbi Research, Pakistan, Vol. II, p. 303.

Freidrich, E.J., Gehan, E. A., Rall, D.P., Schmidt, L.H. and Skipper, H. E, 1966. Quantitative comparision of toxicity of anti cancer agent in mice, rat, hamster, dog, monkey and man. *Cancer Chemotherapy Report* 50(4): 219-244.

Ghani, M.N. (1920). Khazanat-ul-Advia. Munishi Naval Kishore, Lucknow, Vol. III, p. 240.

Hultman E, 1959. Rapid specific method for determination of aldosaccharides in body fluids, *Nature* 10:183(4654):108-9.

Husain, M. 1872. Bahrul Jawahar. Mohd. Ali Bakhs Khan, Lucknow, p. 242.

Ibn Sina, A. A., 1906. Al Qanoon fit-Tib. Munshi Naval Kishore, Kanpur, Vol. II, p. 127.

Kang, H., Kwon, S.R., Choi, H.Y., 2011. Inhibitory effect of *Physalis alkekengi L. var. franchetii* extract and its chloroform fraction on LPS or LPS/IFN-γ-stimulated inflammatory response in peritoneal macrophages. *J Ethnopharmacol.* 26;135(1):95-101.

Montgomery, R, 1957. Determination of glycogen. *Arch Biochem Biophys* 67(2): 378-86.

Nabi, M.G., 1901. Makhzan Mufradat wa Murakkabat-e-Azam. Narain Das Jangali Mal, Delhi, p. 153.

Nadkarni, A.K., 2000. Indian Materia Medica, vol.1, Bombay Popular Prakashan, Mumbai, p. 950.

Rhen, T. and Cidlowski, J. A., 2005. Antiinflammatory action of glucocorticoids--new mechanisms for old drugs". *N. Engl. J. Med.* 353 (16): 1711–23.

Singh, D., 1974. Unani Darvyagunadarsh, 2nd ed. Ayurvedic and Tibbi Academy, Lucknow, Uttar Pradesh, p. 135.

Stephenson N.R., 1954. Assay of adrenocortical hormones on the thymus of the weanling rat, *Can J Biochem Physiol*. 32(6):689-702.

Stephenson, N. R. 1960. The effect of corticosterol analogues on the thymus gland of the immature rat. *Journal of Pharmacy and Pharmacology* 12 (1), 411-15.

Tong, H., Liang, Z., Wang, G., 2008. Structural characterization and hypoglycemic activity of a polysaccharide isolated from the fruit of *Physalis alkekengi* L. Carbohydr. *Polym.* 71: 316-323.

Trease, G. E. and Evan W.C., 2002. Pharmacognosy, the University Press, Aberdeen, p. 479.

Waldman M, Crew RJ, Valeri A, Busch J, Stokes B, Markowitz G, et al. Adult minimal-change disease: clinical characteristics, treatment, and outcomes. *Clin J Am Soc Nephrol*. May 2007; 2(3):445-53.

Wasim, A., Khan, N.A., Ghufran, A., Shamshad A., 2005. Physicochemical Standardization and Pharmacological Study of Some Nephroprotective Unani Drugs, MD Thesis, Department of Ilmul Advia, Faculty of Unani Medicine, AMU, Aligarh, India.

Wasim, Ahmad, Khan, N.A., Ghufran, Ahmad, Shamshad Ahmad, 2010, Effect of Kaknaj (*Physalis alkekengi* fruit) on gentamicin model of acute renal impairment in rats, *Hippocratic Journal of Unani Medicine* 5 (3): 107-117.

Wybenga D.R., Pileggi VJ, Dirstine P.H., Di Giorgio, J., 1970. Direct manual determination of serum total cholesterol with a single stable reagent**.** *Clin. Chem.* 16(12): 980-4.

Younan A. S., 1968. Effect of steroids on thymus lymphoid development *in vitro. The Anatomical Record* 161 (2): 187–195.

Pharma-cognostic Standardization of *Cymbopogon citratus* (DC.) Stapf. Leaf

[1]*Shelvi Agarwal,
[2]Rajeev Kr. Sharma, [3]Sneh Lata

[2] Pharmacopoeial Laboratory for Indian Medicine, Kamla Nehru Nagar, Ghaziabad-201002

[3]Dept. of Botany, MMH College, Ghaziabad-201001

Abstract

attira' ascribed to plant species *Cymbopogon citratus* (DC.) Stapf. belongs to family *Poaceae*. In Ayurveda, it is widely used for treatment of various diseases. It is an important ingredient of Ayurvedic Formulations viz. Sheetaprashamana mahakashaya, Ayurvadya taila, Mahapanchagavya ghrita, Ayurvedic chay etc. It is also used for flavouring soups and curries. An infusion of leaves is sometimes taken as a substitute for tea, a refreshing beverage. The essential oil from *C.citratus* is widely used in perfumery, cosmetic preparations and in aromatherapy. The diagonostic characters obtained from investigated parameters such as organoleptic, microscopical, powder characters, physico-chemical constants, TLC fingerprinting profile of leaf are given. The data obtained by this study lead to Pharmacognostic Standardization of *Cymbopogon citratus* (DC.) Stapf. leaf.

Key words: *Cymbopogon citratus* (DC.) Stapf, Pharmacognosy, Physico-chemical studies

Introduction

'Kattira' ascribed to plant species *Cymbopogon citratus* (DC.)Stapf. syn. *Andropogon citratus* DC. belongs to family *Poaceae*. It is popularly known as Lemon grass. The plant is aromatic, bitter, acrid, stimulant, thermogenic, anthelmentic, laxative, appetizer, alexipharmic, antispasmodic and anaphrodisiac and is useful in helminthiasis, flatulence, gastric irritations, anorexia, poisonous bites, bronchitis, epilepsy, leprosy, skin diseases, cholera, neuralgia, sprains, fever (Sharma *et al.,*2002). In Ayurveda, it is widely used for treatment of various diseases. It is an important ingredient of Ayurvedic Formulations viz. Sheetaprashamana mahakashaya, Ayurvadya taila, Mahapanchagavya ghrita, Ayurvedic chay etc.

Lemon grass is also used for flavouring soups and curries. (Anonymous,1950). An infusion of leaves is sometimes taken as a substitute for tea, a refreshing beverage (Kurup *et al.,*1979). The essential oil from *C.citratus* is widely used in perfumery, cosmetic preparations and in aromatherapy.

Some fragmentary information regarding pharmacognostic evaluation of leaves is available in literature. It is also reported that other species of *Cymbopogon* are used as its adulterants (Datta and Mukerji,1952). Therefore detailed studies in respect of pharmacocognostic standardization was carried out in

*Author for correspondence; [1]III E – 57, Nehru Nagar, Ghaziabad-201001.

view of need for identification and authentication of leaves of this particular species.

Material and Methods

Drug sample collected from Ghaziabad and identified with the help of standard flora (Bor,1982). It was thoroughly washed to get rid of any unwanted foreign organic or inorganic matter, adhered soil and other unwanted parts etc. After washing, it was finally cut to suitable sizes for further proceedings. Hand sections were cut, stained and mounted in Canada balsam for anatomical studies. For powder study Harold *et al*.(1981) was followed. To determine physico-chemical constants, Israili (1971), Indian Pharmacopoeia (2001) was consulted. Behaviour of the powdered drug towards specific reagent was recorded according to Kapoor *et al.*(1975). For fluorescence study schedules mentioned by Chase and Pratt (1949), Kokoski *et al*.(1958) and Trease and Evans(1978) were followed. The colouration was recorded according to Anonymous (1978). Standard prescribed procedures for histochemical studies (Johansen,1940; Datta and Mukerji, 1950; Youngken,1951; Cromwell,1955; Trease and Evans,1978; Henry,2001; Anonymous,2002), Organic group detection (Johansen,1940; Youngken,1951; Robinson,1963; Anonymous,1966; Saxena,1975; Rathore,1977;

Dan *et al*.,1978; Trease and Evans,1978; Gupta *et al.,1*980; Brahman and Saxena,1989), UV Spectroscopy (Willard *et al*. (1965) and Chromatography (Wagner *et al*, 1984) were adopted.

Observations and Results

I. Organoleptic Characteristics:

A. The drug comprises of leaves which are linear, tapering upwards to a long setaceous point, approximately 90-115 cm in length and 1.4-2.0 cm in width. The leaves are eau-de-nil to sea green in colour. The leaves are glaucous, rough along margins, also with slightly rough surface because of protruding veins. The leaves possess parallel venation. Midrib is somewhat stout below and whitish on upper side. The leaves are chartaceous and possess a very strong lemon aroma and bitter taste (Figure 1).

B. The powdered drug is light olive green in colour with a powerful lemon aroma and bitter taste.

Fig. 1: Cymbopogon citratus (DC.) Stapf. Habitat of Plant and Macroscopical Features of Drug . A, Plant in Natural Habitat;
B, Fresh Leaf; C, Dried Leaf.

II. Micro-morphological Characteristics:

The transverse section of leaf shows an upper epidermis and lower epidermis covered with thick cuticle. Some of the cells of upper epidermis are comparatively larger (bulliform cells). In surface view, epidermis shows polygonal to tubular cells. Some of the marginal cells of leaf are provided with hair which are rhomboidal in shape and possess pointed end. Stomata are distributed on both surfaces and are multistomatic. It also shows abundance of hair bases or hair with elongated base and hemispherical to tapering apex, long cells more or less rectangular with slightly sinuous walls, short cells over the vein and silica bodies which are near to cross shape (Figure 2). Beneath

each epidermis, there are sclerenchymatous patches at close intervals. The vascular system contains a number of large and small vascular bundles. The bundle sheath of each vascular bundle possesses a tier of parenchymatous cells followed by another tier of palisade-like cells. Large vascular bundles have prominent sclerenchymatous patches on both and upper lower ends extending between the bundles and epidermal layers. The large bundles have distinct phloem towards lower epidermis and xylem towards the upper epidermis. Phloem consists of sieve tubes and companion cells. The xylem has two pitted, oval metaxylem vessels, tracheids in between metaxylem vessels, scanty xylem parenchyma and protoxylem vessel. Protoxylem vessel is located towards upper epidermis and is represented by a lysigenous cavity. The small vascular bundles are also surrounded by bundle sheaths and contain distinct but less developed xylem and phloem. The bundles are conjoint, collateral and closed. The transverse section of midrib shows similar structure as in case of a vein (Figure 3 and 4).

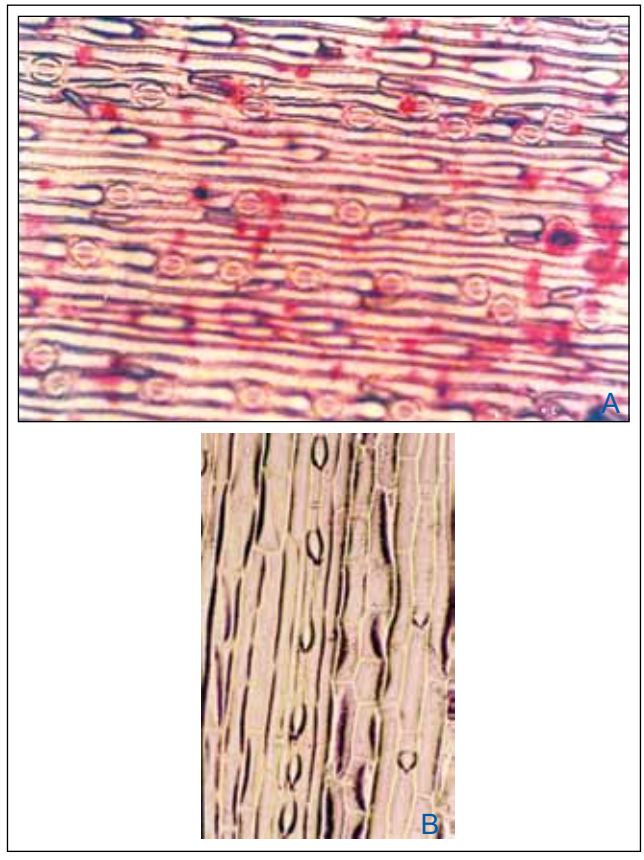


Fig. 2: Surface view of *Cymbopogon citratus* (DC.) Stapf leaf

A. Surface view of lower epidermis with stomata (St) and hair (H) 100X
B. Surface view of upper epidermis showing hair (H), long cell (Lc), short cell (Sc) and Silica bodies (Sibd) 200X

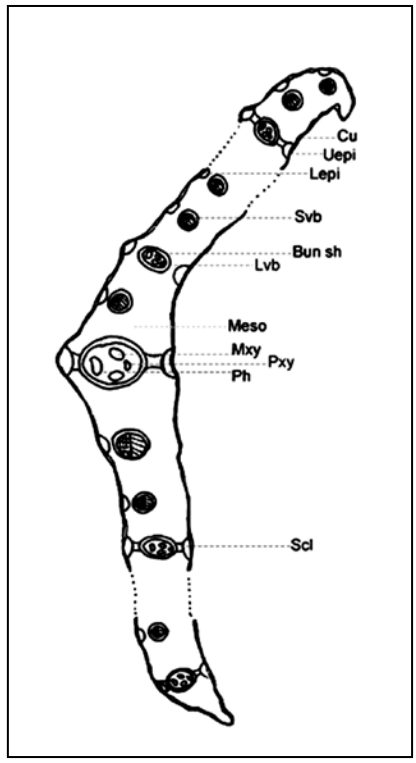


Fig. 3: Line diagram of Cymbopogon citratus (DC.) Stapf. in transverse view (60X)

Abbreviations: Bun sh-bundle sheath; Cu-Cuticle; Lepi-lower epidermis; Lvb-large vascular bundle; Meso-mesophyll cells; Mxy-metaxylem; Ph-phloem cells; Pxy-protoxylem; Scl-patches of sclerenchyma; Svb-small vascular bundle; Uepi-upper epidermis

The microscopic dimensions of individual cell of different tissues of drug and cell contents are enumerated in Table 1.

Table-1: Dimensions of cellular elements and cell contents in transverse section.

Cellular Elements/Cell Contents	Measurements(m)
	Length × Width
Cuticle	1.50-3.00-3.75 (T)
Upper epidermis cells	7.50-18.75-30.00 (D)
Bulliform cells	30.00-60.00-90.00 (D)
Lower epidermis cells	15.00-22.50-26.25 (D)
Stomata	30.00-30.00-45.00 × 9.40-11.25-11.25
Sclerenchyma cells	11.25-18.75-30.00 (D)

Cellular Elements/Cell Contents	Measurements(m)
	Length × Width
Spongy parenchyma cells	18.75-22.50-30.00 (D)
Metaxylem vessels	15.00-45.00-60.00 (D)
Protoxylem vessels	7.50-26.25-37.50 (D)
Phloem cells	7.50-15.00-22.50 (D)
Outer bundle sheath cells	26.25-30.00-37.50 × 15.00-18.75-22.50
Inner bundle sheath cells	15.00-22.50-30.00 (D)
Hair	15.00-22.50-30.00 (L)
Starch granules	3-5-6 (D)

Abbreviation: 'D' refers to diameter, 'T' refers to thickness and 'L' refers to length.

Quantitative Microscopic Characters:

The observations of stomatal indices of upper and lower surfaces and the palisade ratio of palisade-like cells on upper and lower surfaces are cited in the Table 2.

Table 2: Quantitative Microscopy.

S. No.	Parameter	Surface of leaf	Mean±SD
1.	Stomatal indices	Adaxial	4.53 ± 1.40
		Abaxial	15.78 ± 0.85
2.	Palisade ratio	Adaxial	18.40 ± 1.14
		Abaxial	17.95 ± 0.57

The leaves of ***C.citratus*** have parallel venation and there, vein-islet number of the same could not be determined as they possess no definite vein-islets.

Powder Study:

The powdered drug is characterized by fragments of lower epidermis in surface view showing stotata and hair, fragments of marginal cells with hair which are rhomboidal in shape and possess pointed end, vessels with annular and reticulate thickenings and simple pits, mesophyll cells with oil content, starch granules, simple, round to oval, sclereids with pits, fragments showing fibres and associated sclereids and parenchyma cells in longitudinal view, broken fibres with tapering ends, fragments showing sclerenchyma and hair (Figure 5).

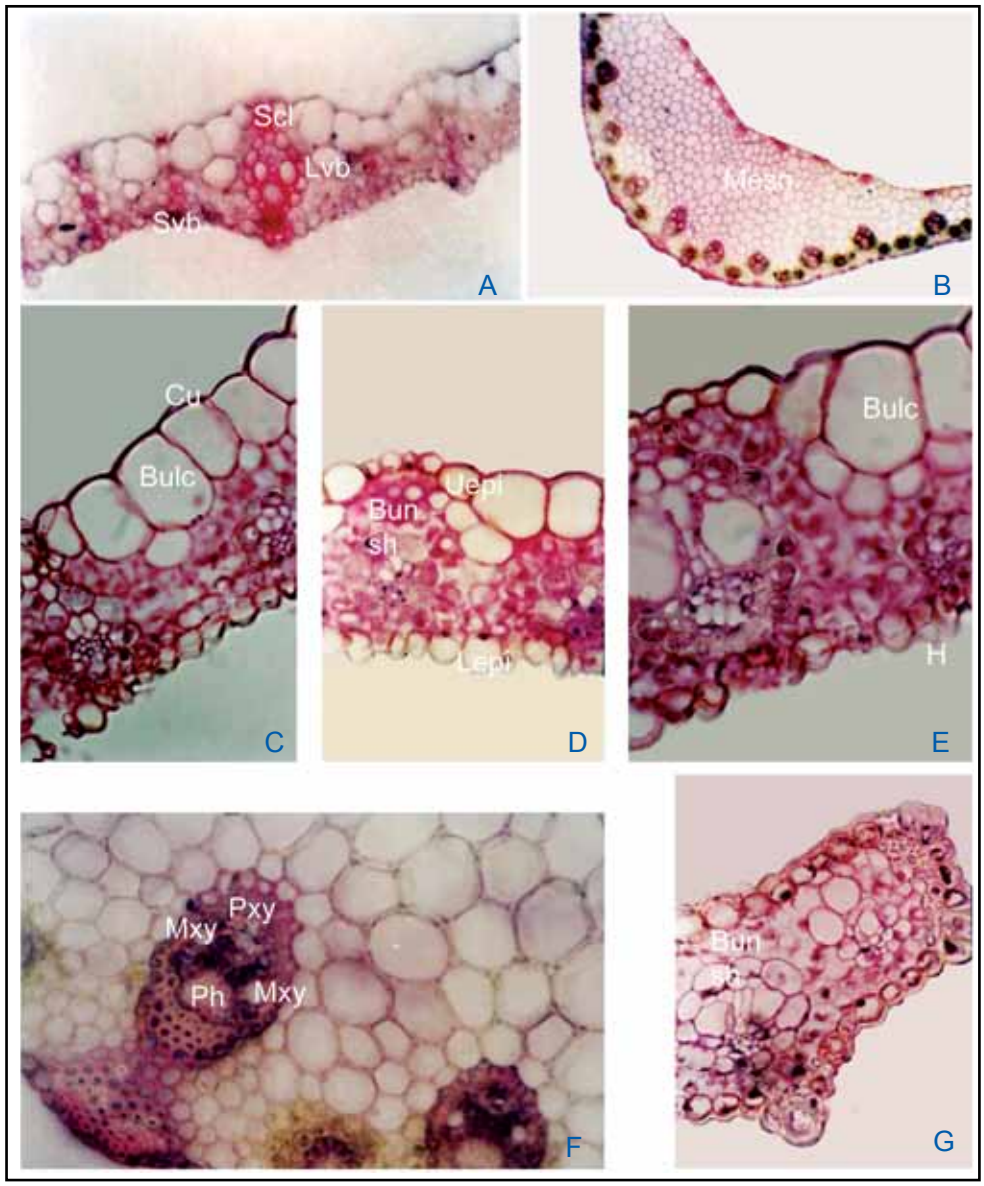


Fig. 4. Photomicrographs of *Cymbopogon citratus* (DC) Stapf. in transverse view

A	Lamina portion showing large and small vascular bundle and patches of sclerenchyma	200X
B.	TS through Midrib	40X
C.	Cuticle and bulliform cells	400X
D.	Upper and lower epidermis and bundle sheath	400X
E.	Bulliform cells and hair	400X
F.	Phloem cells, protoxylem and metaxylem	200X
G.	Bundle sheath	400X

Abbreviations: Bulc-bulliform cells; Bun sh-bundle sheath; Cu-Cuticle; H-hair; Lepi-lower epidermis; Lvb-large vascular bundle; Meso-mesophyll; Mxy-metaxylem; Ph-phloem cells; Pxy-protoxylem; Scl-patches of sclerenchyma; Svb-small vascular bundle; Uepi-upper epidermis

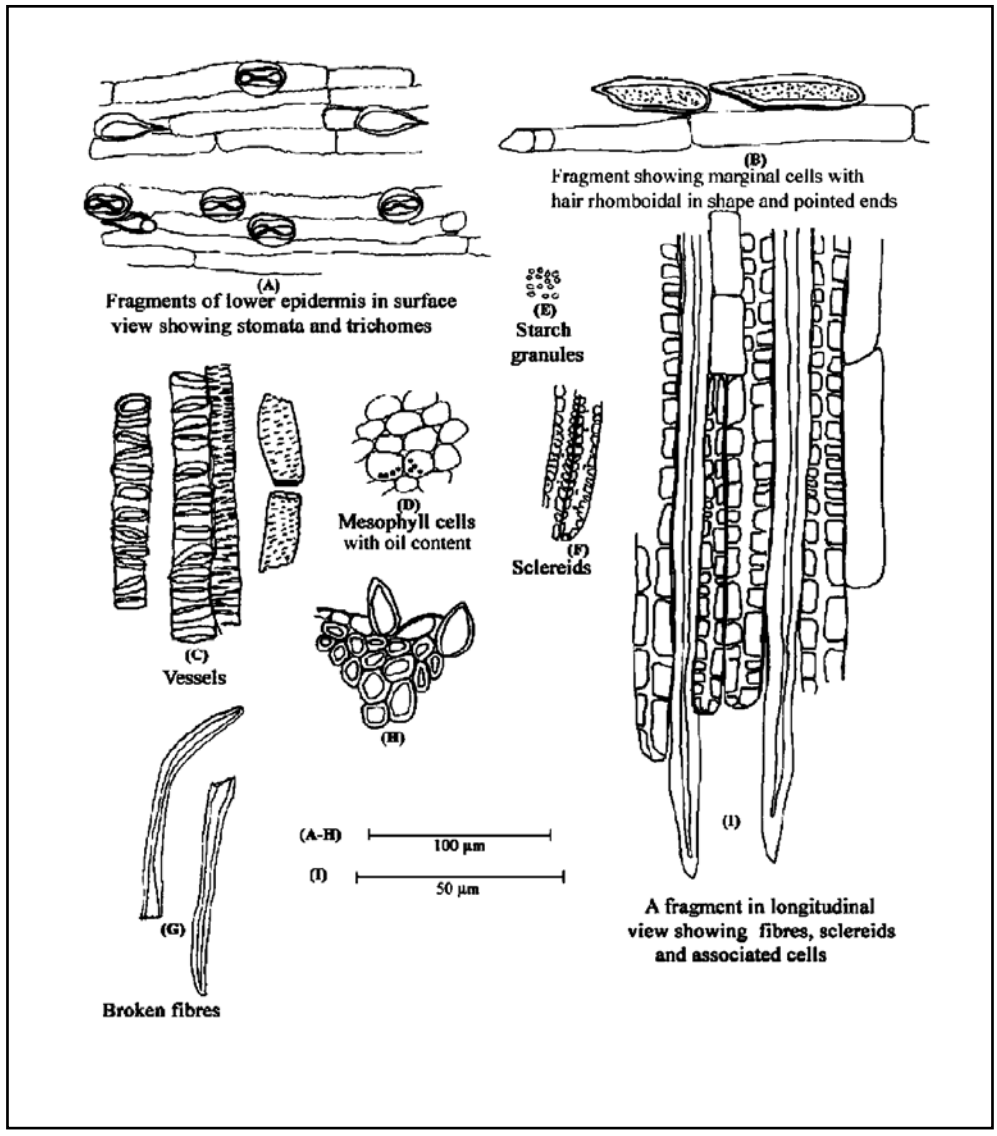


Fig. 5. Powder Characteristics

III. Histochemistry

A. *Micro-Chemical Tests and Behaviour of Specific Reagents Towards Plant/ Drug Tissues:* Observations and results pertaining to the observations of Micro-chemical Tests and behaviour of specific reagents towards Plant/ Drug Tissues Table-3.

Table-3: Micro-chemical Tests and behaviour of specific reagents towards plant tissues and cell contents.

Sl. No.	Reagents	Test	Infer-ence	Histological zone/Cell contents responded
1.	Dragendorff's reagent	Alkaloid	+	Cells of epidermis, vascular bundle and sclerenchyma
2.	Wagner's reagent	Alkaloid	+	Same as above
3.	Acetic acid	Calcium oxalate	−	Not responded
4.	Hydrochloric acid + Potassium hydroxide solution (5% w/v)	Calcium oxalate	−	Same as above
5.	Iodine sol. followed by sulphuric acid	Cellulose	+	Cells of parenchyma and bundle sheath
6.	Sudan III	Fixed oils and fats	+	Oil globules in mesophyll and sclerenchyma cells
7.	Phloroglucinol-HCl	Lignin	+	Cells of sclerenchymatous patch, xylem and bundle sheath
8.	Lugol's solution	Protein	+	Cells of epidermis, vascular bundle and sclerenchyma
9.	Saturated aqueous solution of copper acetate	Resin	+	Cells of bundle sheath of large vascular bundle
10.	Iodine solution weak	Starch	+	Starch grains in cells of bundle sheath and parenchyma
11.	Potassium hydroxide solution (5% w/v)	Starch	+	Same as above
12.	Sudan III	Suberin	+	Cells of sclerenchyma and epidermis
13.	Fehling's solution	Sugar	+	Cells of epidermis and phloem
14.	Aqueous ferric chloride	Tannin	+	Cells of sclerenchyma

B. *Behaviour of Powdered Drug towards Specific Reagents:* The powdered drug was treated with specific reagents and the resultant behaviour is represented in Table-4.

Table-4: Behaviour of Powdered Drug on Treatment with Different Chemical Reagents.

Sl. No.	Reagents	Behaviour of the powdered drug
1.	Acetic acid	Powdered drug settles at bottom giving a primrose solution.
2.	Dragendorff's reagent.	Most of the particles float on surface and rest remain suspended in solution giving a deep orange solution.
3.	5% aqueous ferric chloride solution	Most of the particles float on surface and rest settle down giving a golden brown solution.
4.	Hydrochloric acid	All the particles float on surface giving a light jasmine solution.
5.	Iodine solution	Most of the particles settle down and few particles float on surface giving a light purple brown solution.
6.	Lactic acid	Powdered drug floats on surface giving a royal ivory solution.
7.	Nitric acid	All the particles come to upper side giving a traffic yellow solution.
8.	Saturated picric acid	Some of the particles float on surface and rest of the particles settle down giving a lemon solution.
9.	5% potassium hydroxide	Entire powdered drug settles down giving a middle stone colour.
10.	Concentrated sulphuric acid	All the particles come to upper side giving a middle brown solution.
11.	Water	Particles float on surface giving a middle buff solution.

IV. Identity, Purity and Strength

Physico-Chemical Characteristics: The analytical values in respect of physico-chemical characteristics of drug were observed and their statistical data is quoted in the Table-5.

Table-5: Statistical Data of Physico-Chemical Constants of Drug

Sl. No.	Physico-chemical constants	Mean±sd
1.	Moisture content, %w/w	12.55 ± 0.18
2.	pH	7.17 ± 0.03
3.	Total ash, %w/w	9.54 ± 0.30
4.	Acid insoluble ash, %w/w	5.81 ± 0.07
5.	Water soluble extractives, %w/w	12.39 ± 0.04
6.	Alcohol soluble extractives, %w/w	5.25 ±0.03

V. Fluorescence and Spectroscopy

A. *Fluorescent Characteristics of Powdered Drug on Screening under Ultra-Violet Light:* Powdered drug was screened for fluorescent characteristics with or without chemical treatment. The observations of fluorescence analysis of powdered drug pertaining to their colour under normal day light and UV light are presented in the Table-6.

Table-6: Fluorescent Characteristics of Powdered Drug under Ultra-Violet Light.

Sl. No.	Treatment	Colour in normal light	Colour in UV light
	Powder		
1.	mounted in 1N sodium hydroxide in methanol.	Light olive	Sage green
2.	mounted in 1N hydrochloric acid.	Light jasmine yellow	Sea green
3.	mounted in 1N sodium hydroxide in water.	Light brown	Sea green
4.	treated with concentrated nitric acid diluted with an equal amount of water.	Primrose	Sea green
5.	treated with concentrated sulphuric acid diluted with an equal amount of water.	Orange brown	Light bronze green
6.	in water.	Middle buff	Sea green
7.	with ethyl acetate.	Light olive	Eau-de-Nil
8.	with petroleum ether.	Frost green	Cool breeze
9.	with acetone.	Canary yellow	Sea green

Sl. No.	Treatment	Colour in normal light	Colour in UV light
	Powder		
10.	with benzene.	Mid cream	Eau-de-Nil
11.	with chloroform.	Light olive	Sea green
12.	with carbon tetrachloride.	Light olive	Sea green
13.	with methanol.	Light olive	Eau-de-Nil
14.	with ethanol.	Nut brown	Light bronze green
15.	as such.	Light stone	Light olive

B. *Ultra-Violet Spectroscopy*: The data pertaining to UV spectrophotometric characteristics is computed in the Table-7 (Figure 6).

Table-7: Ultra-Violet Spectrophotometric Characteristics of Drug.

λ max, nm	Maximum absorption peaks at dilution 0.5/25 ml/ml
667.0	0.050
266.0	0.803
235.1	3.221
231.9	1.940
226.0	2.523

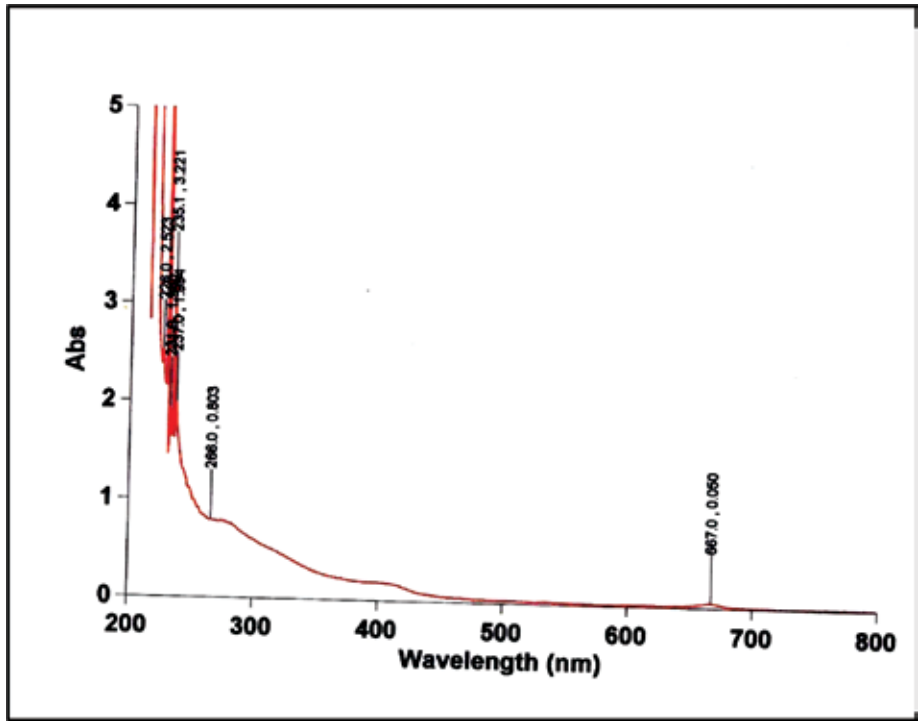


Fig. 6. Ultra-Violet Spectrophotometric Characteristics of Cymbopogon citratus (DC.) Stapf

VI: Chromatography

Thin-Layer Chromatography: The TLC fingerprinting data is presented in Table-8.

TLC of Hexane extract on aluminium plate precoated with silica gel 'G' 60 F254 of 0.2 mm thickness using Toluene: Ethyl acetate (9:1) as solvent system and when seen under UV 366 nm shows bands at Rf 0.25 (Red), 0.34 (sky blue) and 0.40 (Red). On dipping in *Vanillin Sulphuric Acid reagent* and on heating at 105^0 for 5 minutes bands appear at Rf 0.10, 0.26, 0.38 (All grey).

Table-8: TLC Fingerprinting Data

Sl. No.	Technical detail	Specification
1.	Stationary phase	Hexane extract on aluminium plate precoated with silica gel 'G' 60 F254 of 0.2 mm thickness
2.	Solvent system	Toluene: Ethyl acetate (9:1)
3.	Derivatizing reagent	Vanillin Sulphuric Acid reagent
4.	Extract	Hexane extract
5.	Volume of test solution applied	7ml
6.	Distance traveled by solvent system	8 cm
7.	Spots in visible light, Rf	-
8.	Spots under UV(366 nm), Rf	3 spots, 0.25 (Red), 0.34 (Sky blue) and 0.40 (Red)
9.	Spots after derivatization, Rf	3 spots, 0.10, 0.26, 0.38 (All grey)

Discussion

The pharmacognostic study of *Cymbopogon citratus* (DC.)Stapf..was attempted by a few workers. Datta and Mukerji (1952) described macro- and microscopic characters of the drug which are in accordance with the findings of present study. However Chauhan and Pillai (2007) reported presence of prismatic crystals of calcium oxalate in powder characteristics of drug which are not found in this investigation. It is an important medicament of cosmetics, certain classical and patent and proprietary preparations. These pharmacognostic and other related quality parameters can be used to identify and authenticate commercial available lemon grass.

References

Anonymous,1950. The Wealth of India. Raw materials,Vol. II, C.S.I.R., New Delhi. pp. 411-414.

Anonymous,1966. Pharmacopoeia of India. Manager of publications, Govt. of India, New Delhi.

Anonymous,1978. Indian Standard Colours for Ready Mixed Paints and Enamels. 3rd rev., ISI, New Delhi.

Anonymous,2001. Pharmacopoeia of India. Manager of Publications, Govt. of India, N. Delhi.

Anonymous,2002. Quality control methods for medicinal plant materials. WHO, Geneva.

Bor, N.L., 1982. Flora of Assam. Vol. V Graminae. (Rep.). Published under the authority of Govt. of Assam, AVON Book Company, Delhi, pp. 387-388.

Brahmam,M. and H.O.Saxena,1989. Phytochemical screening of the plants of Gardhamardan hills of Orissa(India) for tannins, saponins, flavonoids and alkaloids. *Asian J. Pl. Sci.* 1:89-92.

Chase,C.R. and R.J.Pratt,1949. Fluorescence of powdered vegetable drugs with particular reference to development of a system of identification. *J. Amer. Pharm. Assoc.* 38:324-331.

Chauhan, M.G. and Pillai, A.P.G., 2007. Microscopic profile of powdered leaf drugs used in Indian System of Medicines. Vol. 2, pp. 26- 27.

Cromwell,B.T. in Peach,K. and M.V.Tracy,1955. Modern methods of plant analysis. Vol.4, Springer-Verlag, Heidelberg.

Dan,S.S.; N.R.Mandal and S.Dan,1978. Phytochemical screening of some plants of Indian Botanic Garden. *Bull. Bot. Surv. India* 20(1-4):117-123.

Datta, S.C. and B.Mukerji,1950. Pharmacognosy of root and rhizome drugs. Pharmacognosy Lab. Bull. I, Manager of Publications, New Delhi.

Datta,S.C. and B.Mukerji,1952. Pharmacognosy of Indian Leaf drugs. Pharmacognosy Lab.Bull.No.2, Govt. of India, Calcutta.

Gupta,O.P., T.N.Srivastava, S.C.Gupta and D.P.Badola,1980. An ethno-botanical and phyto-chemical screening of high altitude plants of Ladakh. Part-I. *Reprint-Bulletin* 1(3):301-317.

Harold,Egan; Ronald,S.Kirk and Ronald Sawyer,1981. Person's Chemical Analysis of Foods. Churchill Livingstone, London.

Henry,J.B.,2001. Clinical Diagnosis and Management by laboratory methods. 20th Edn. Published by W.B.Saunders Company, Philadelphia, Pennsylvania.

Israili,A.H.,1971. Standardization of Jawarish Jallinos. *Planta Medica* 20(1):60-66.

Johansen,D.A.,1940. Plant Microtechniques. McGraw Hill Book Co., New York.

Kapoor,S.L., R.Mitra and L.D.Kapoor,1975. Pharmacognostic study of the root and rhizome of *Parnassia nubicola* Wall. ex Royle(Fam. Parnassiaceae). A species used as 'Mamira'. *Bull. Bot. Surv. India* 17(1-4):1-6.

Kokoski,J., R.Kokoski and F.J.Slama,1958. Fluorescence of powdered vegetable drugs under UV radiation.*J. Amer. Pharm. Assoc.*47(10):715.

Kurup,P.N.V., V.N.K.Ramadas and P.Joshi,1979. Handbook of Medicinal Plants. C.C.R.A.S., New Delhi.

Rathore,Y.K.S.,1977. Chemical study of constituents of some Indian plants. D. Phil. Thesis. Allahabad Univ., Allahabad.

Robinson,T.,1963. The organic constituents of higher plants. Burgus Publishing Co., U.S.A..

Saxena,H.O.,1975. A survey of the plants of Orissa(India) for tannins, saponins, flavonoids and alkaloids. *Lloydia* 38(4):346-351.

Sharma,P.C., M.B.Yelne and T.J.Dennis,2002. Database on Medicinal Plants Used in Ayurveda. Vol.5, C.C.R.A.S., Govt.of India, Ministry of Health and Family Welfare, New Delhi, pp.445-477.

Trease,G.E. and W.C.Evans,1978. Pharmacognosy. 11th edn., Bailliere Tindall, London.

Wagner, H., Bladt, S. and Zgainski, E.M., 1984. Plant Drug Analysis. Springer-Verlog, Berlin Heidelberg, New York Tokyo, p.176.

Willard,H.H., L.L.Merrit and J.A.Dean,1965. Instrumental methods of analysis. 4th edn.,Affiliated East-West Press Pvt. Ltd., New Delhi.

Youngken,H.W.,1951. Pharmaceutical Botany. 7th edn., The Blakistan Company, Toronto.

Leaf Architecture of a Unani drug 'Sarphuka' (*Tephrosia purpurea* (L.) Pers.) : An Aid to Identification

[1]*Kiran Negi, [2]Aminuddin and [1]M.S.Y. Khan

[1]Drug Standardisation Research Unit (Central Council for Research in Unani Medicine), Hamdard University, New Delhi - 110062

[2]Central Council for Research in Unani Medicine, 61-65, Institutional Area, Janakpuri, New Delhi-110058

Abstract

In nature, different species exhibit remarkable diversity of leaf morphology. In systematic and taxonomic classification, leaf architecture has long been the important criterion and even today it is the best means of identifying a plant species. In view of this, present work is undertaken on the leaf architecture of ***Tephrosia purpurea* (L.) Pers.** (family : Fabaceae) an important drug of Unani system of medicine, popularly known as **"Sarphuka"** and is considered as anthelmentic, blood purifier, antitumour, alexiteric and antipyretic in Unani system of medicine . Tender leaves showed good results in treating eczema and other skin disorders. The leaf decoction is used for treating sluggish fever, heart and spleen disorders, cancerous tumors, asthma and digestive complaints. The work focus on the macroscopic features of the leaf blade including leaf characters (leaf shape, size, margin etc.) ; venation and surface characters (stomata, stomatal number, stomatal index, vein islet number etc.) which are important determinant of leaf architecture. All these characters along with the internal architecture of the leaf (microscopical details) provide a framework to facilitate quick identification and selection of the drug from various adulterants.

Keywords: *Tephrosia purpurea* (L.) Pers., *Leaf architecture*, *Stomata, Adulterants*, *Stomatal index*.

Introduction

The angiosperm flora exhibits a wide range of leaf architecture. Although foliar architecture as a taxonomic tool has been in use since a long time, the coherent classification of dicotyledons leaf architecture by Hickey (1973) has stimulated a wider interest in the subject. In the recent past, a large number of workers have successfully used these characters in classifying both extinct and extant plant materials of complex taxonomic groups. (Inamdar and Murty, 1981; Jain, 1978; Mishra, 1970; Roth Nebelsick *et al*., 2001; Singh *et al*., 1976; Rao and Narmada, 1994). A perusal of literature, however, reveals that the study on leaf architecture of *Tephrosia purpurea* (L) Pers. has received little attention. The present investigation, is therefore, undertaken to provide a framework for quick identification and selection of the drug from various adulterants.

Tephrosia purpurea (L) Pers. belongs to family Fabaceae and is popularly known as "Sarpunkha". Being hot 3° and dry 3° it has been used for centuries

* Author for correspondence

in unani system of medicine to cure various ailments. It possess various pharmacological activities like antidiabetic, antiepileptic, anti carcinogenic, antimicrobial, antibiotic, anti inflammatory, analgesic, antiulcer, anti hyperlipidemic, immunomodulatory, hepato protective and wound healing. Tender leaves showed good results in treating eczema and other skin disorders. The leaf decoction is used for treating sluggish fever, heart and spleen disorders, cancerous tumors, asthma and digestive complaints (Khatri *et al*., 2008; Joshi, 2000; Kavita and Manoharam, 2006; Kirtikar and Basu, 1988; Lodhi *et al.*, 2006).

Systematic position of *Tephrosia purpurea* (L) Pers.

Kingdom : Plantae

Division : Magnoliophyta

Class : Magnoliopsida

Order : Fabales

Family : Leguminosae (Fabaceae)

Genus : Tephr*osia*

Species : *purpurea* (L) Pers.

Vernacular Names

Urdu : Sarabhuka

Bengali : Bannilgachh, Sarphonka

English : Wild Indigo

Gujrati : Ghodakan, Jhila, Sarpankho, Sharpankho

Hindi : Sarphoka, Sarphonka, Dhamasia

Kannada : Empali, Vajaraneeli, Koggili

Malyalam : Kolinnil, Kozhenjil, Kaatamiri

Oriya : Kolothiyapokha, Mohisiakolothiga, Pokha, Soropokha

Punjabi : Bansa, Bansu, Jhojhru, Sarpankh, Sarphonka

Sanskrit : Banapunkha, Ishupunkhika, Kalashaka, Kalika, Kandapunkha, Kriti, Sharapunkha

Tamil : Kolingi, Paavali, Katkolingi, Kolluk-kay-velu

Distribution

Throughout the plains of India, Ceylon, Mauritius, Tropical Africa & Sub tropical region (2, 10).

Description of the plant

Herb, perennial, 30 – 60 cm. tall, many branched, puberulant, densely spreading villous or glabrescent; stem nearly erect to spreading, with a woody base, ridged; flowers ca. 8mm, calyx 2 – 4 x ca.3 mm, teeth equal, corolla mauve, standard orbicular, white puberulent, ovary with trichomes, with 5 – 8 ovules; legumes lilnear 3 – 5 cm x 3.5 – 4 mm with sparse appressed trichomes, apically slightly curved; seed ca. 6 per legume, grayish brown, ellipsoid ca. 3 x 15 mm, with spots, smooth (Fig. A).

Flowering : March – October

Fruiting : September – December

Material and Methods

Ten *Tephrosia purpurea* (L) Pers. plants from the campus of Jamia Hamdard, New Delhi contributed the material for the present study and details are given in Table 1.

Table 1: Histological Quantitative Study

S.No.	Characters	Number	Range
1.	Stomatal Index		
	(i) On adaxial surface	15.8	11-24
	(ii) On abaxial surface	12.4	6-16
2.	Palisade ratio	4.38	3-6
3.	Vein – islet Number	23 - 28	14-29
4.	Vein – termination Number	24	12-33

Stomatal Studies

For stomatal measurements, the 1st pair of fully expanded leaves were used. A strip of lower epidermis from the middle portion of the leaf was peeled off and mounted in glycerol and stained in safranin. The number of stomata in 30 randomly selected microscopic field areas from six leaves was counted per

plant to obtain stomatal and epidermal cell frequency. Leaf area per stomata was calculated based upon the stomatal frequency per unit area. Stomatal index (SI) was calculated according to the formula of Salisbury (1927)

$$SI = S / E + S \times 100$$

Where S is the number of stomata per unit leaf area and E is the number of epidermal cell per unit leaf area.

Leaf Venation Pattern

Fully expanded leaves from the terminal part of the branch were collected from ten representative plants. Leaves were immersed in 80% ethanol form 48 - 72 hrs. with several changes of the solvent in order to remove chlorophyll pigments. The leaf samples were then washed and treated with 3 – 5 % NaOH for 24 – 36 hrs. The digested leaf tissue was carefully brushed apart to obtain the leaf skeleton. These are further hardened by treating with saturated chloral hydrate solution for several days, washed, dehydrated and preserved. Major venation pattern was studied and absolute vein islet number and absolute vein – termination number were calculated by Gupta (1961) and terminology of Hickey (1973) is followed for the description of leaf architecture.

Results

Leaf characters : Leaf of *Tephrosia purpurea* (L) Pers shows following characters :-

Leaf : compound, imparipinnate , stipules narrowly triangular

Rachis size : 7 -15 cm including petiole ca. 1 cm

Leaflet (Fig. 1 - 6, 11)

Number : 9-17 (-21)

Shape : obovate to narrowly elliptical

Terminal leaflet size : 7-28 mm x 2 – 11 mm

Lateral leaflet size : 5 – 30 mm x 2 – 11 mm

Base : acute

Apex : obtuse

Margin : entire

Venation : distinct on both surface

Leaflet surface : Abaxial – appressed pubescent

Adaxial – glabrous

Stomata : usually anisocytic and paracytic

Microscopy

T. S. through the lamina of the leaflet shows single layer of upper epidermis covered by cuticle. Mesophyll is differentiated into two rows of palisade cells and a central and spongy parenchyma region. Vascular bundles are embedded in between. Lower epidermis single layered with stomata and covered by cuticle. Non-glandular hairs are present in the lower epidermis. The hairs are non-glandular, simple, elongated and aseptate (Fig. 3 & 4).

Fig 1: x4 leaflet showing vein islets

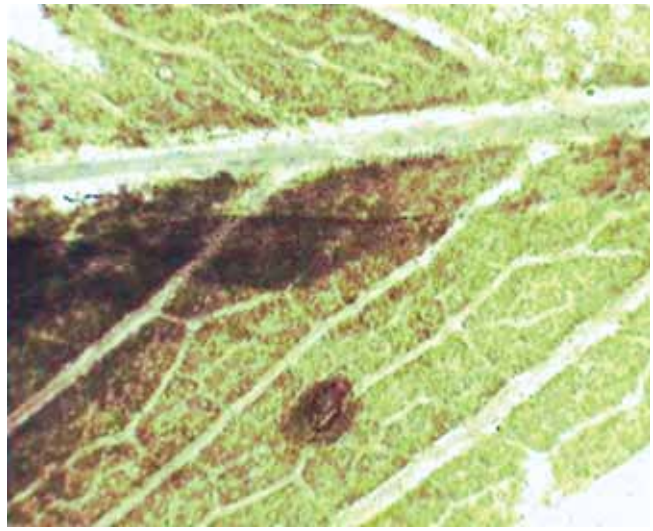


Fig 2: x4 leaflet showing mid vein and parallel veins

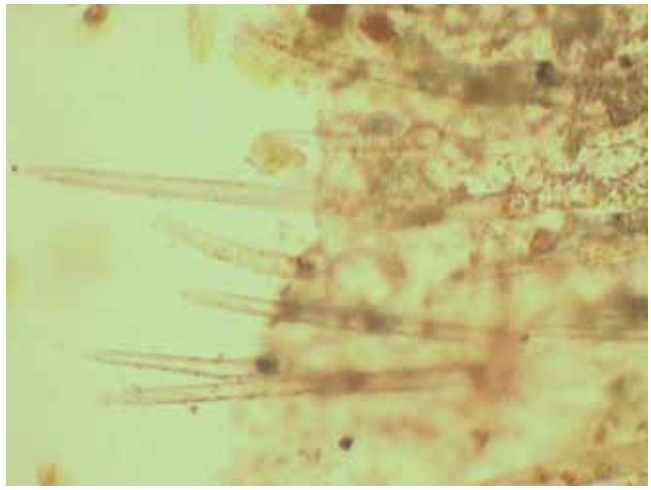


Fig. 3: x40 leaflet showing trichomes (surface view)

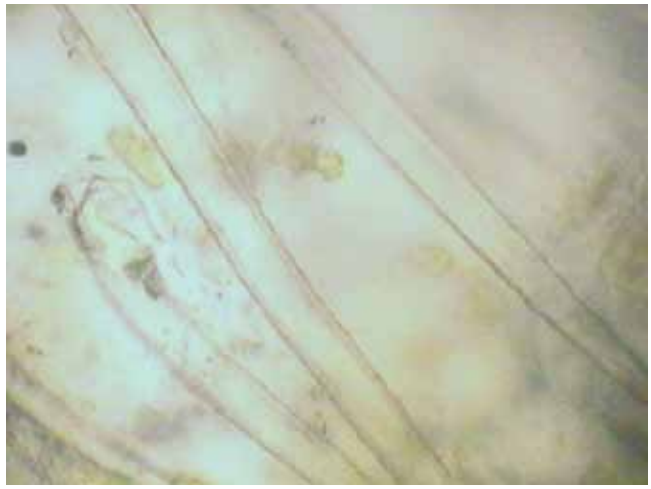


Fig. 4: x100 leaflet trichomes (enlarged view)

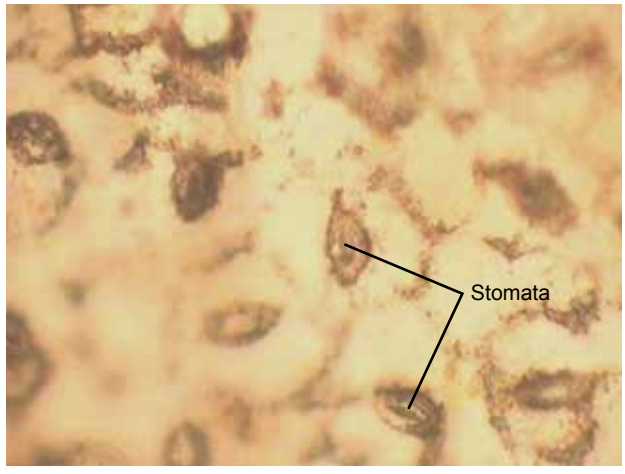


Fig. 5: x100 leaflet showing stomata (surface view)

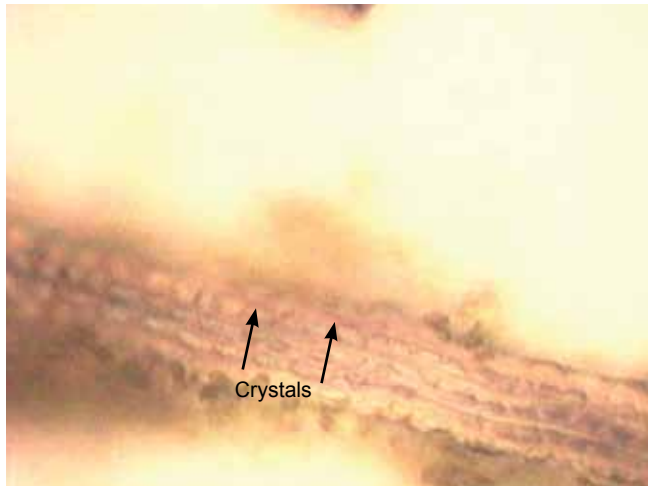


Fig. 6: x40 Leaflet showing veins crystals (surface view)

Leaflet architecture of *Tephrosia purpurea* Pers.

A T.S. through midrib region shows that the palisade is discontinuous over the meristele region and the vascular tissue exhibits an arc of xylem with phloem beneath. This group of bundle is protected with above and below by an arc of lignified fibers which is somewhat ovate in shape above and crescent shape below. The upper ridge of the midrib is composed of a group of collenchymatous cells (Fig. 7, 8).

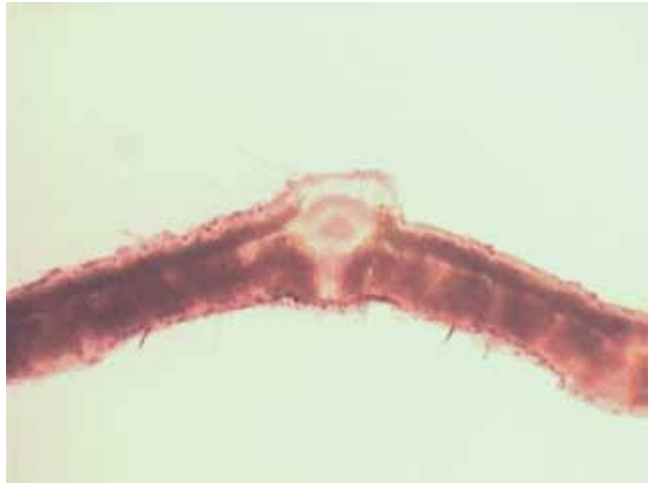


Fig. 7: x10 T.S. of leaflet showing Vascular bundle

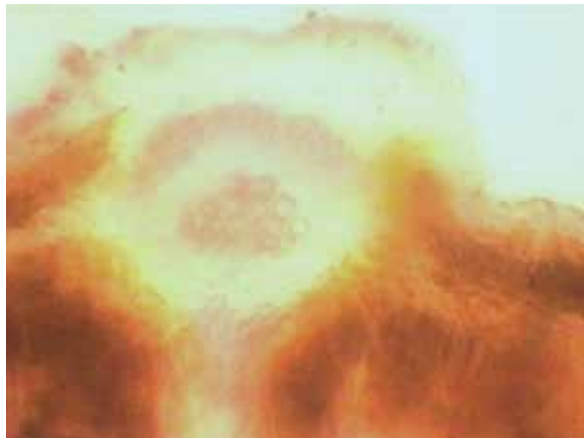


Fig. 8: x40 T.S. leaflet showing V.B.(enlarged view)

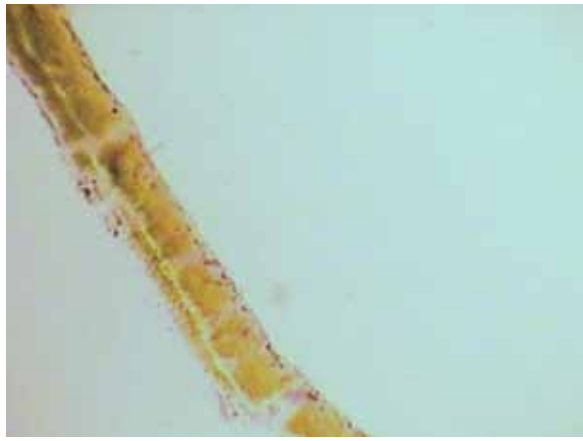


Fig. 9: x10 T. S. lamina

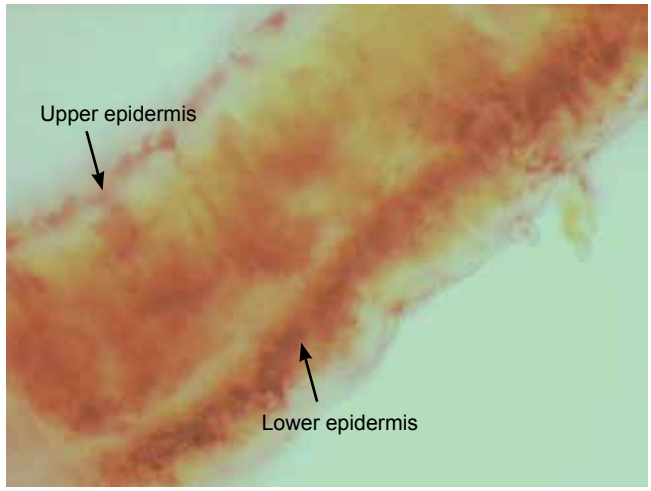


Fig.10: x40 T.S. lamina (enlarged view)

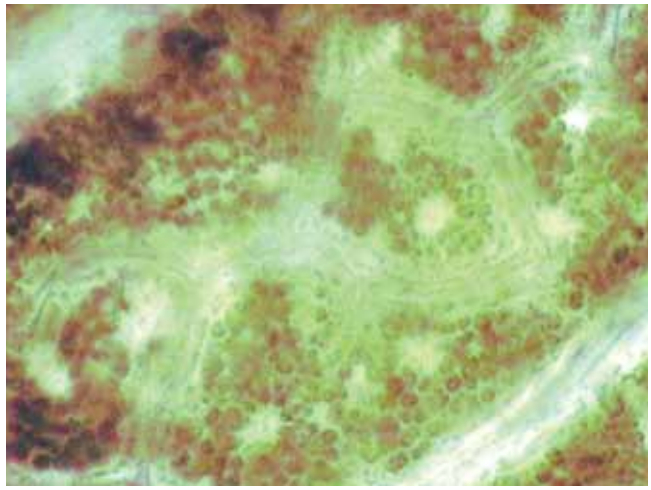


Fig.11: x40 Upper surface of leaflet withour trichomes

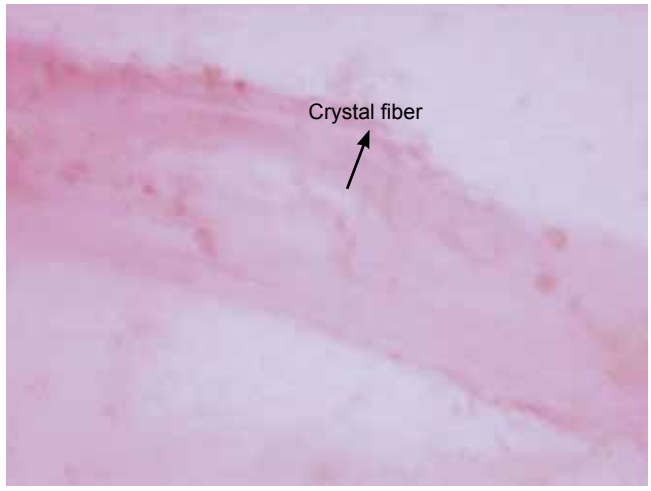


Fig. 12: x40 Crystal fibers

Leaflet architecture of *Tephrosia purpurea* Pers.

Conclusion

In nature, there is remarkable diversity of leaf morphology among different species of a plant. 24 species of *Tephrosia* were recorded in India. Leaf architecture study of *Tephrosia purpurea* (Linn) Pers. shows many distinctive features that act as an important tool in identifying the plant specie and differentiating the species from its adulterants.

Tephrosia purpurea (Linn) Pers. has compound, imparipinnate leaf, leaflets four to ten pairs, obovate to narrowly elliptical, almost glabrous above and pubescent beneath with anisocytic and paracytic type of stomata on both the surfaces.

Stomatal index is a significant tool in identifying the species of a plant as it is not affected by the factors like the age of the plant, size of the leaf, environmental condition etc. It is relatively constant for a species. Study of stomatal index shows a range of 11 -24 (adaxial surface) and 6-16(abaxial surface) in *Tephrosia purpurea* (Linn) Pers leaf.

Similarly ,Vein islet, that is used to distinguish between drugs of closely related specie does not alter with the age of a plant and is independent of the size of the leaf. It is also constant for a given species. Study shows that *Tephrosia purpurea* (Linn) Pers leaf have vein-islet number within the range of 14-29.

Besides these characters, *Tephrosia purpurea* (Linn)Pers leaf shows non glandular, simple, elongated and aseptate trichomes, crystal sheath surrounding the large vascular bundle which are capped by fibre strands on both adaxial and abaxial side and presence of collenchyma cells on the upper ridge of the midrib.

Acknowledgements

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

References

Chopra R.N., Nayar S.L., Chopra I.C., 1956. Glossary of Indian Medicinal Plants, CSIR, New Delhi, India

Gupta B., 1961. Correlation of tissues in leaves, absolute vein-islets number and absolute vein-islet termination number. *Am.J. Botany* 25 : 65-70

Hickey L. J., 1973. Classification of the architecture of dicotyledons leaves. *Am. J. Bot.* 60: 17-33

Inamdar J.A. & Murty GSR, 1981. Leaf architecture in some Solanaceae. *Flora* 167 : 265-272

Jain D.K., 1978. Study in Bignoniaceae III Leaf architecture. *Journal of Indian Botanical Society* 57 : 369-387

Joshi S.G., 2000. Medicinal Plants. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

Kavita K,Manoharan S., 2006. Anticarcinogenic and anti lipiperoxidative effects of *Tephrosia purpurea* (Linn) Pers. in 7-12-dimethylbenz (a) anthracene (DMBA) induced hamster buccal pouch carcinoma. *Indian Journal of Pharmacology* 38: 185-189

Khatri, Amit, Arun Garg, Shyam S. Agarwal, 2008. Evaluation of hepatoprotective activity of aerial parts of *Tephrosia purpurea* L. and stem bark of *Tecomella undulata*. *Journal of Ethnoparmacology* 122 (1) : 1 - 5

Kirtikar K.R. & Basu B.D., 1988. Indian Medicinal Plants. Periodical Experts Book Agency, Vivek vihar , Delhi 32

Lodhi S., Pawar R.S., Jain A.P., Singhai A.K., 2006. Wound healing potential of *Tephrosia purpurea* (Linn) Pers. in rats. *Journal of Ethnopharmacology* 108, 204-210

Mishra M K (19970: Stomatal characteristics at different ploidy level of *Coffea arabica* L. *Am. J. Botany* 80 : 689-692

P. Pavana, S. Monoharan, G.L. Renju, S.Sethupathy, 2007. Antihyperglycemic and anti hyperlipidemic effects of *Tephrosia purpurea* leaf extract in streptozotocin induced diabetic rats. *Journal of Environmental Biology* 28 (4): 833-837.

Rajal Shah, Sachin Parmar, Punit Bhatt, Sunita Chandra, 2011. Evaluation of Hepatoprotective activity of Ethyl acetate fraction of *Tephrosia purpurea. Pharmacologyonline* 3 : 188-194

Rao, Sharnmukha S.R. and K. Narmada, 1994. Leaf architecture in some Amaranthaceae. *Journal of Botanical Taxonomy & Geobotany* 105 (1-2) : 37-44

Roth Nebelsick A , UHL D, Morbrugger V and Karp H. 2001. Evaluation and function of leaf venation architecture. *Ann. Botany* 87 : 553-566

Salisbury E.J., 1927. On the causes and ecological significance of stomatal frequency with special reference to the woodland flora. Philosophical Transactions of the Royal Society, B 216 : 1-65

Singh V., Jain D.K. & Sharma M., 1976. Leaf architecture in *Salix*. *Journal of Indian Botanical Society* 55 : 140-150

A Monographic Profile of *Coriandrum sativum* Linn. : An Official Drug of Ayurvedic, Unani and Siddha Systems of Medicine

[1]*Nitin Rai, [2]Rajeev Kr. Sharma* **and**
[2]A.K. Verma

Deptt. of Botany, M.M.H. (PG) College, Ghaziabad- 201002

[2]*Pharmacopoeial Laboratory for Indian Medicine, Kamla Nehru Nagar, Ghaziabad-201002, India

Abstract

oriandrum sativum (L.) is widely used as drug in Ayurvedic, Unani and Siddha Systems of medicine. The drug (dried fruit), which is aromatic, carminative, digestive and laxative, is chiefly used as spice in commerce. Very few clinical studies on modern lives have been conducted on this drug. The approved modern therapeutic application for coriander is based on its long history of use in Ayurveda, Unani and Siddha systems of Medicine. The present studies deal with detailed pharmacognosy and review the related aspects of this important drug.

Key Words – *Coriandrum sativum* Linn., Drug standardization, Quality specifications.

Introduction

Coriandrum satvium (Family: Apiaceae) commonly known as 'Coriander', is used in Ayurvedic, Unani and Siddha system of medicine since time immemorial as aromatic, carminative and also in laxative preparations to prevent griping. The drug is known as 'Dhanyka' (Ayurveda),'Kishneez' (Unani) and 'Kottumalli vitai' (Siddha) in Sanskrit, Urdu and Tamil respectively in different systems of medicines. The young leaves are used as a garnish in cooking and seeds as flavouring ingredient in all types of food products. Coriander is carminative, diuretic, stomachic, laxative, refrigerant and aphrodisiac. It has bactericidal and fungicidal properties. The quality parameters of the drug are also part of regulatory standards in drugs and food as spice (Anonymous, 1955; 1966; 1986; 1987; 1998 and 2008).

Methodology

Drug samples were collected from different places with a view to find out any significant difference present within the same species. For studying powder, Jackson and Snowdon (1992) was followed. To determine physico-chemical constants, Indian Pharmacopoeia (Anonymous, 1966) was consulted and for fluorescence study schedules mentioned by Trease and Evans (1972) were followed. Colours were named by consulting Rayner (1970). Standard prescribed procedures for histochemical studies (Johanson, 1940; Youngken, 1951; Cromwell, 1955, Trease and Evans, 1978), organic group detection (Robinson, 1963); U.V. Spectrophotometry (Willard, *et al*., 1965) and Chromatography (Shellard, 1968; Stahl, 1969; Smith and Feinberg, 1972) were adopted. The informatics is complied by reviewing the available literature.

*Author for correspondence

Systematics

Family: Apiaceae

Genus: – *Coriandrum* Linn.

The genus comprises two species in Mediterranean one species is cultivated throughout India for spice and herbage.

Coriandrum sativum Linn. Sp. Pl. 256. 1753; FBI.2: 717; FUGP. 1: 397; Buw. Blumea 2: 171.1936: Fl. Males.Ser. 1.4: 128. 1949; Hiroe, Umbel. Asia 1: 127.

Erect, glabrous, annual, aromatic herbs, 15-20 cm tall. Basal leaves plamately lobed-partite; segments ovate, toothed, margined.Cauline leaves pinnately dissected or decompounds; segments linear-oblog.flower small, white or pinkish purple in compound terminal umbels and axillary.Calyx-teeth 0.5-1 mm long, lanceolate.Petals 5, obovate-spathulate,spreading white-pinkish; marginal petals 4-5 mm long, incurved. Fruits yellowish brown 2.5-4 mm long, sublobose, ribbed, separating into two halves (mericarp) each containg a seed (Fig 1 A).

$CH_3 - (CH2)_9 – CH = CH - CHO$

Tridecenal

Linalool

D-Linalool Geraniol 1, 8-Cineole Camphor -Pinene Limonene

Flowering: December-January.

Fruiting: April-May.

Distribution: Native of Mediterranean and cultivated throughout India sometimes also found as an escape in waste places and roadside. It cultivated in all the country like Russia, Thuringia, Moravia, Hungary, northern Africa and Malta (Sharma *et al.,* 2002).

Drug Specification: The drug consists of ripe, more or less spherical fruits (cremocarp or double achenes), which have mostly not split into the mericarps. The ridges fist become visible on drying.

Nomenclature

The plant is known by different vernacular names e.g. Dhan (Bengali), Konphir (Gujarati), Dhaniya, Dhanya (Hindi), Kottampala, Kottamalli, Malli and Kottampalari (Malayalam), Dhanya, Khotbir, Khotmir, and Kothmir (Marathi), Dhania (Oriya), Dhania (Punjabi), Dhaniya, Kottamalli (Tamil), Daniyalu, Kotimira (Telugu), Akkishneez (Urdu) and Dhano (Sindhi) etc.

Chemical Constituents

Coriander fruit contain about 2-3% volatile oil, the major component for pleasant smelling α-linalool, which is present 70-90%, depending upon ripeness of the fruit. Other compounds are decyl aldehyde, trans-tridecene – (2) -al- (1), borneol ,geraniol, geranyl acetate, camphor, carvone, anethole, caryophyllene oxide,elemol, methylheptenone monoterpene hydrocarbons (α-pinene, β-pinene limonene, β-phellandrene, γ terpine, β-sistosterol, D-mannitol, flavonoid glycosides, coriandrinonediol, quercetin- 3- 0- coffeyl-glucoside, ∆ octadecenoic acid ,citrollol, geraniol, thymol, linalyl acetate, geranyl acetate. It also contain 26% fats made up of glycerides,proteins (11-17%), 1.0% starch, 20% sugars, coumarins (psoralen, angelicin, scopoletin, umbelliferone, etc.), rutin, tannins, chlorogenic and caffeic acid. coriander leaves contain less volatile oil, oxalic acids, vitamin C,calcium and carotene. Other components which are present in coriander plants are triacontane, triacontanol, coriandrones C to E, quercetin, oflatoxins B1 and B2 and a new compound trance-tridecene-(2)-al-(1) (tridecenal) is responsible for the bug like smell of the green plant (Shah and Qudry, 1990-91; Leug and Foster,1996).

Pharmacology

Fruit extract of *C. sativum* Linn. inhibits mycelia growth of *Pythium aphnidermatum.*The essential oil has strong antifungitoxicity at very low concentrations. The drug is known to possess, because of essential oil, stomachic, spasmolytic and carminative properties (Pandey and Pant, 1975; Bisset, 1994).

Therapeutic and non-Therapeutic Uses

Leaves are aromatic, astringent, carminative, antibilious, antiflammatory, analgesis, styptic and native useful in halitosis, pharyngopathy, expistaxis, ulemorrhagia, chronic conjunctivitis, hiccough, inflammation, suppuration, hemorrhoids, jaundice and odontalgia.

The fruits are aromatic, sweet, bitter, acrid, astringent, emollient, anti-inflammatory, anthelmintic, stomachic, carminative, antibilious, digestive, appetizer constipating, diuretic, antipyretic, stimulant, expectorant, aphrodisiac, refrigerant, tonic anodyne, cough, bronchitis, sore throat, common catarrh, vomiting, dyspepsia, anorexia, diarrohea, colic, flatulence, dysentery, chronic conjunctivitis, haemorrhoids, helminthiasis, headache, epistaxis, erysipelas, carbuncles, ulcers, strangury, scrofula, helminthiasis, gout, rheumatism, intermittent fever, giddiness hyperpiesia and gout . Oil is useful in flatulent colic, rheumatism and neuralgia. (Prajapati *et. al.*, 2003). In folck medicine the drug is supportive in treatments for complaints of the upper abdomen, such as a feeling of distension, flatulence and mild cramp-like gastrointestinal upset.

The green leaves of coriander used as garnish in cooking. The seed are used as flavour ingredient in all types of food products, especially as a spice. The essential oil is used as an aroma substance in the tobacco and perfumery industries. It also used alcoholic, nonalcoholic beverages, candy, backed goods, meat products, relishes and others.

Classical Formulations

The drug is used as an ingredient in a various classical formulations of Ayurveda,Unani and Siddha systems of medicine. The seeds are utilized in preparation of -

Ayurveda - Dhanyapancak kvatha churna (Anonymous, 1986).

Unani - Khamira Gao Zaban Sada,Khamira Gao Zaban Ambari Jawahar Wala,Jawarish-e-Shahi,Intrifal-eKishneezi,Dawa-ul-Misk Motadil Sada,Qurs-e-Ziabetus Sada, Arq-e-Musaffi-e-Khoon Qawi (Anonymous, 1998).

Siddha - Inci Vatakam, Naratai Ilakam, Pitta Curam Kutinir (Anonymous, 2008).

Modern Medicine (as per Indian Pharmacopoeia) - Coriandri Pulvis, Tincture Rhei Coposita, Extractum sennae lignidum (Anonymous, 1955, 1966).

Safety Aspects

Allergic reactions like contact dermatitis are known to be associated with the use of powdered coriander and more particularly with oil (Bisset, 1994 and Evans, 1977).

Dosage and mode of administration (Kapoor, 1990)-

Powder : 4-8 g

Oil : 0.1-0.3 ml

Infusion : 12-20 ml

Adulterants and Substitutes

Similar small fruits and seeds like fenugreek seeds, stems, and cereal fruits are present in as adulterant, Bombay coriander fruits and ground coriander is more prone to adulteration; these fruits are ellipsoidal, 5-8 mm long, 3-4.5 mm wide and contain less volatile oil.

Regulatory Status- An official drug in –

i. Ayurvedic Pharmacopoeia of India, Part I, Vol. I.

ii. Ayurvedic Formulary of India, Part I & II.

iii. Unani Pharmacopoeia of India Part I & Vol. I.

iv. National Formulary of Unani Medicine Part I-V.

v. Siddha Pharmacopoeia of India, Part I, Vol. I.

vi. Siddha Formulary of India, Part I.

vii. Indian Pharmacopoeia, 1955; 1966.

Observations

I. Organoleptic Characteristics

Entire Drug- Fruits are globular, mericarps usually united by their margins forming a cremocarp about 3-5 mm in diameter, uniformly brownish-yellow or brown, glabrous, sometimes crowned by the remains of sepals and styles, primary ridges 10 wavy and alight inconspicuous secondary ridges 8, straight, and more prominent ; in the central region of the pericarp the cells are fuciform and sclerotic forming in each mericarp a thin hemispherical shell of compact hard tissue which makes the fruit difficult to cut and troublesome to powder, the seed is endosperm coelospermous; odour , aromatic; taste spicy and characteristic [Fig. 1 B, C)].

Powdered Drug – The powdered drug is yellowish brown in colour with pleasant aromatic odour and spicy taste (Fig. 1 D).

A. Flowering Plant

B. Seeds

C. Seeds (Magnified)

D. Seed Powdered

Coriandrum sativum Linn

II. Micro-Morphological Characteristics

Entire Drug - Transverse section of fruit show composed of polygonal tabular cells of pericarp with slightly thickened anticlinal wall; trichomes and lignified reticulate parenchyma are outer layer of mesocarp is parenchymatous with inner cells in wavy longitudinal rows and degenerated vittae as tangentially flattened cavities; middle layer of mesocarp sclerenchymatous forming a thick layer of fusiform, pitted cells in very sinuous rows, layer often crossing at right angles with definite longitudinal strands in the secondary cells of mesocarp, large, hexagonal with rather thin, lignified walls; inner epidermis of the pericarp is composed of frequentry cells and the hypodermis of large slightly thickened, flattened hexagonal sclernchyma; endosperm of thick-walled cellulosic parenchyma containing fixed oil, numerous – aleurone grains, about 4-8 in diameters containing micro-rosettes of calcium oxalate; split carpophore passing at apex of each mericarp into raphe,adjacent to which a large cavity

and on inner side of this a flattened vascular stron; carpophore consisting of fibers surrounded by spiral vessel.

Powdered Drug - Powdered drug under microscopy exhibit epicarp; thin walled cells, polygonal in shape the surface view contain smooth cuticale.Each cell contain 1 or more prismatic calcium oxalate. Stomata are present. The vittae are elliptical, schizogenous, secretory cavities varying in size from about 150-300 microns, long axis and 60-70 microns, short axis. They are flanked by thick walled cells. Occasional brown polygonal vittae present in surface view. Mesocarp; is of two type outer layer mesocarp 4 layers of tangentially oblong, thin walled, parenchyma cells, there is also a fiber layer consisting of densely packed sclerenchya fiberes,sinous,fusiform cells with a narrow lumen, inner mesocarp consisting 3 layers thin walled tangentially elliptical cells. Endocarp; consist of layer of tangentially long, narrow, lignified cells.Testa; single layer brown in colour, thin-walled, polygonal in surface view. Endosperm; thick-walled cells containing aleurone, grains and micro-rosettes of calcium oxalate (Fig. 2).

III. Histochemistry

Micro – Chemical Tests and Behaviour of specific reagents towards Plant/Drug Tissues – Observations and results pertaining to micro-chemical tests and behaviour of specific reagent towards plant tissues are presented in Table-1.

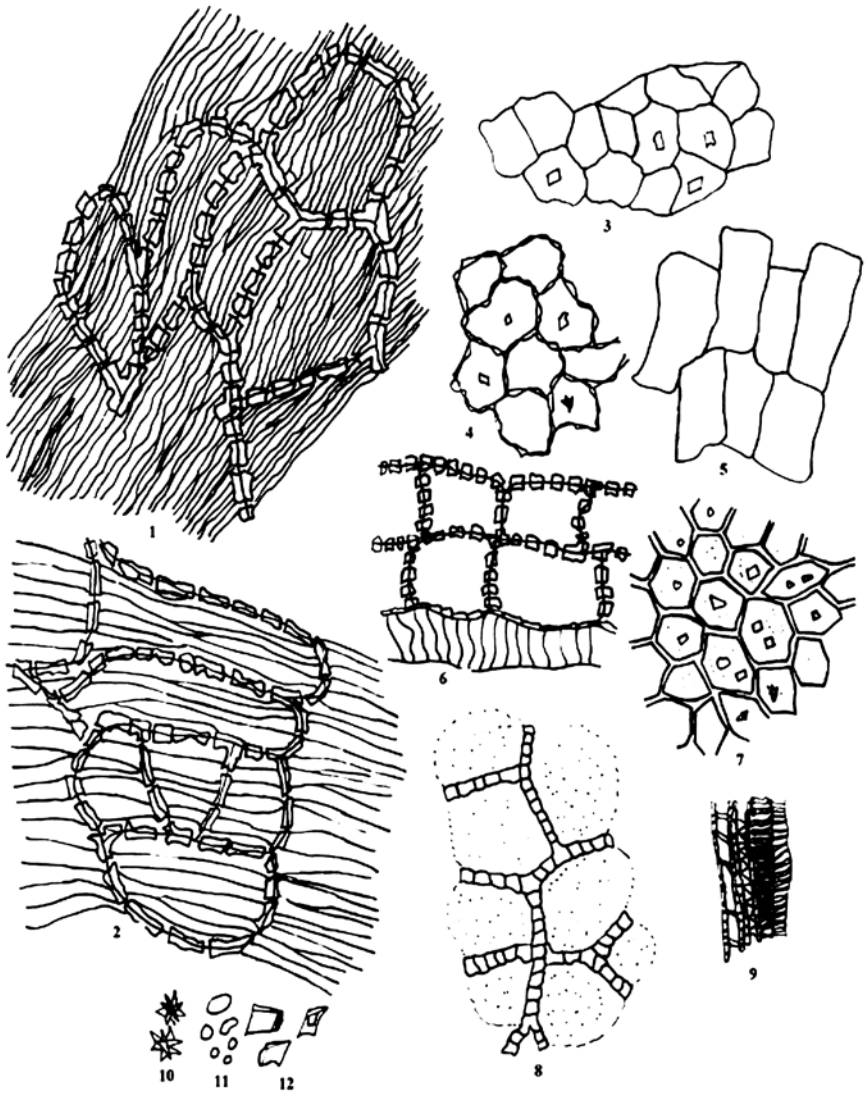
Table-1: Micro-chemical Tests and behaviour of specific reagents towards plant tissues and cells contents.

Sl. No.	Reagent	Test for	Infer-ence	Histological zone/cell contents responded
1.	Dragendorff's reagent	Alkaloid	-	Not responded.
2.	Marme's reagent	Alkaloid	-	Not responded.
3.	Wagner's reagent	Alkaloid	-	Not responded.
4.	Potassium hydroxide solution (5% w/v)	Anthocynin	-	Not responded.
5.	Sulphuric acid (66% v/v)	Anthocynin	-	Not responded.
6.	Acetic acid	Calcium oxalate	+	Epicarp and endosperm cells

Sl. No.	Reagent	Test for	Infer-ence	Histological zone/cell contents responded
7.	Potassium hydroxide solution (5% v/v) + Hydrochloric acid	Calcium oxalate	+	Same as above
8.	Sulphuric acid	Calcium oxalate	+	Same as above
9.	Kedde reagent	Cardiac glycoside	-	Not responded.
10.	Iodine Solution followed by Sulphuric acid	Cellulose	+	Epicarp, mesocarp and other cellular region
11.	Sudan III	Fixed oil and fats	+	Vittae,endosperm and mesocarp cells
12.	Chlor-zinc-Iodine Solution	Latex	-	Not Responded
13.	Aniline sulphate Solution followed by Sulphuric acid	Lignin	+	Sclereids in mesocarp
14.	Phloroglucinol HCl	Lignin	+	Same as above
15.	Lugol's solution	Protein	+	Endosperm cells
16.	Millon's reagent	Protein	+	Same as above
17.	Picric acid	Protein	+	Same as above
18.	Heating with KOH (5% w/v) + HzSO4	Suberin	-	Not responded.
19.	Sudan III	Suberin	-	Not responded.
20.	Weak Iodine solution	Starch	-	Not responded.
21.	Potassium hydroxide solution (5% w/v)	Starch	-	Not responded.
22.	Sulphuric acid	Starch	-	Not responded.

Indications: '-'Absence and '+' presence of constituent.

Organic Groups of Chemical Constituents – The extracts of the drug were tested for presence of different organic groups and results are presented in Table – 2.



Coriandrum sativum

1.2. Rectangular sclereids of the mesocarp with underlying endocarp cells in surface view, 3. Epicarp in surface view with calcium oxalate prism in cell, 4. Parenchymatous tissue in surface view, 5. Testa in surface view, 6. Fragment of pericarp, 7. Endosperm cells with crystal and aleurone grains, 8. Fragment of secretary duct, 9. Vessels, 10. Cluster crystal, 11. Oil globules, 12. Prism of crystals.

Fig. 2

Table-2: Major Group of Organic Chemical Constituents of Drug.

Sl. No.	Organic Groups of Chemical Constituents	Reagents / Tests	Inference
1.	Alkaloid	Dragendorff's and Mayer's reagents	-
2.	Anthraquinone	Borntrager reaction	+
3.	Coumarin	Alcoholic potassium hydroxide	+
4.	Flavonoid	Shinoda reaction	+
5.	Glycoside	Mollisch's test	+
6.	Protein	Xanthoprotein test	+
7.	Resin	Ferric chloride regent	+
8.	Saponin	Libermann-Burchard reaction	-
9.	Steroid	Salkowski reaction	+
10.	Tannin	Gelation test	+

IV. Identity, Purity & Strength

Physico-Chemical Constants – The analytical values in respect of physico-chemical constant of drug were established and results are reported in Table-3.

Table-3: Analytical Values of Physico-chemical Constants

Sl. No.	Physico-Chemical Constants	Analytical values
1.	Moisture content, % w/w	2.5
2.	Total Ash, % w/w	6.0
3.	Acid insoluble ash, % w/w	1.5
4.	Alcohol soluble extractive % w/w	10.0
5.	Water soluble extractive % w/w	19.0
6.	Essential oil, %, v/w	0.3

V. Fluorescence & Spectroscopy

Fluorescence Characteristic of Powdered drug under Ultra-Violet Light – Powdered drug was screened for fluorescence characteristic with or without chemical treatment. The observations pertaining to their colour in daylight and under ultra-violet light were noticed and are presented in Table-4.

Table-4: Fluorescence Characteristic of Powdered Drug under Ultra-Violet Light.

Sl. No.	Treatments	Coriandrum sativum	
		Colour in day light	**Nature of colour in fluorescence**
1.	Powder as such	Yellowish brown	Brown
2.	Powder with		
	Carbon tetra chloride	Brown	Brownish yellow
	Ethyl acetate	Light brown	Brownish yellow
	Hydrochloric acid	Greenish brown	Brown
	Nitric acid + water	Light brown	Greenish yellow
	Sodium hydroxide + methanol	Yellowish brown	Brown
	Sodium hydroxide + water	Greenish brown	Dark brown
	Sulphuric acid + water	Light brown	Reddish brown
	Buffer- pH 5	Light brown	Brown
	Buffer- pH 7	Light brown	Greenish brown
	Buffer- pH 9	Light brown	Greenish brown

Ultra-Violet Spectroscopy – The data related to Ultra-Violet Spectrophotometric characteristics as computed in Table-5.

Table-5: Ultra-Violet Spectrophotometer characteristic of drugs

Sl. No.	Specifications	Data
1.	Tincture dilution ml/ml	0.02
2.	Maximum absorption peak	0.141 0,111 0.306
3.	l Maxima at, nm	275.10 266.50 223.05

VI. Chromatographic Profile

Thin-Layer Chromatography – Best separation for TLC fingerprinting were obtained by using different layers and solvent systems. Inferences are shown in Table-6.

Table-6: TLC fingerprinting data

S. No.	Drug	Mobile Phase/ Solvent System	Derivatizing Reagents	Visualizations	No. of Spots	Rf Values of bands
2.	Coriandrum sativum	Toluene: Ethyl acetate (9:1) v/v	Anisaldehyde-Sulphuric Acid	Under UV 254 nm	_	No significant bands
				Under UV 366 nm	3	0.30(red), 0.36 (sky blue), and 0.43 (red)
				After derivatization	6	0.30,0.36 (both violet), 0.43 (grey), 0.47, 0.55 (both light violet), and 0.86 (dark grey)

Discussion

The fruits of *C.sativum* Linn. are used in a number of classical, patent and propertiery formulations of Ayurveda, Siddha and Unani preparations. It is also most commonly used as a spice. Pharmacopoeia provides its specification in respect of macro-morphology, micro-morphology, physico-chemical constants (total ash value, alcohol insoluble, water soluble extractive and alcohol soluble extractive), assay (essential oil limits) and Thin layer chromatography. Prevention of Food Adulteration Act (PFA) also provides limited specifications viz. foreign matter, insect damaged matter, moisture and total ash (Table. 7) in respect of dried mature fruits and its powder. Indian Pharmacopoeia (1955, 1966) also provides specifications for dried ripe fruit and oil derived from the fruits of *C. sativum* Linn. (Table.8). In the present study, pharmacognostic standardization of ripe fruit of *C.sativum* Linn is carried out which can be a pointer in the quality control of *C.sativum* Linn. widely used as drug or spice and also other commodity of commerce. The monographic profile on *C. sativum* Linn. is an attempt to review the compiled information on different aspects of this drug with a view to strictly enforce quality checks on ISM pharmaceutical products.

Table-7: Regulatory Specifications for fruits of *C. sativum* Linn. in different regulatory compendium.

Sl. No.	Quality Specification	Ayurvedic Pharmacopoeia of India (API)	Unani Pharmacopoeia of India (UPI)	Siddha Pharmacopoeia of India (SPI)	India Pharmacopoeia '66 (IP'66)	Prevention of Food Adulteration (PFA)
1.	Official Title	Dhanyka	Kishneez	Kottumalli vitai	Corriander, Corriand.	Coriander (Dhaniya)
2.	Botanical Species	Coriandrum sativum Linn.(Fam. Apiaceae)	C. sativum Linn. (Fam. Apiaceae)	C. sativum Linn. (Fam. Apiaceae)	C. sativum Linn. (Fam. Apiaceae)	C. sativum Linn. (Fam. Apiaceae)
3.	Morphological part/Official part	Dried ripe fruits	Dried ripe fruits	Dried ripe fruits	Dried ripe fruits	Dried mature fruits
4.	Description	I. Macroscopic II. Microscopic III. Powder	I. Macroscopic II. Microscopic III. Powder	I. Macroscopic II. Microscopic III. Powder	I. Macroscopical II. Microscopical	–
5.	Identity, Purity & Strength					
	Foreign Matter	12.0 %, Not more than	2.0 %, Not more than	2.0 % ,Not more than	2.0 %, Not more than	2.0 %, Not more than
	Total Ash	6.0% Not more than	6.0%, Not more than	6.0%,Not more than	–	–
	Acid insoluble ash	1.5% ,Not more than	1.5% ,Not more than	1.5% ,Not more than	1.5%, Not more than	1.5%, Not more than
	Alcohol soluble extractive	10.0% ,Not less than	10.0%, Not less than	10.0%, Not less than	–	–
	Water soluble Extractive	19.0%, Not less than	19.0% ,Not less than	19.0%, Not less than	–	–
	Volatile Oil (Assay)	0.3 %, Not less than	0.3 % ,Not less than	0.3 %,Not less than	0.3 %, Not less than	0.3 % ,Not less than
6.	Thin layer chromatography	–	–	TLC profile	–	–
7.	Extraneous Matter including dust dirt, stones, lumps of earth, chaff, stalk, stem or straw, edible seeds of fruit other than coriander and insect damaged seeds	–	–	–	–	8.0 %, w/w, Maximum

Sl. No.	Quality Specification	Ayurvedic Pharmacopoeia of India (API)	Unani Pharmacopoeia of India (UPI)	Siddha Pharmacopoeia of India (SPI)	India Pharmacopoeia '66 (IP'66)	Prevention of Food Adulteration (PFA)
8.	Insect Damaged Matter (partially or wholly bored by insects)	–	–	–	–	5.0 , w/w %,Maximum
9.	Powder's Specification	–	–	–	–	Rough or fine powder powder obtained by grinding clean, dried coriander fruits.
10.	Moisture content in powder	–	–	–	–	12.0% ,w/w, Not more than
11.	Total ash in powder	–	–	–	–	7.0 % ,w/w, Not more than
12.	Acid insoluble ash in powder	–	–	–	–	1.5% ,w/w, Not more than
13.	Added colouring matter in powder	–	–	–	–	Free from Added colouring matter

Table-8: Regulatory Specification for oil of *C. sativum* Linn in Indian Pharmacopoeia.

Sl. No.	Quality Specification	Indian Pharmacopoeia (1955 and 1966)
1.	Official Title	Coriander oil, Coriand. Oil, oleum Corianderi,oil of Coriander
2.	Botanical Species	Coriandrum sativum Linn.
3.	Official product	Volatile oil distilled with steam from the dried fruit of Coriandrum sativum Linn.
4.	Description	A colourless or pale yellow liquid; odour and taste, those of Corriander.
5.	Solubility	Soluble in 3 volumes of alcohol (70%)
6.	Weight per ml.	At 250, 0.863 to 0.875g
7.	Refractive index at 250	At 200, 1.4620 to 1.4720
8.	Optical Rotational (+80 to + 150)	+ 80 to + 150
9.	Heavy Metals	Conformance to prescribed test

References

Anonymous, 1955. Pharmacopoeia of India. Manager of Publications, Govt. of India, New Delhi.

Anonymous, 1966. Pharmacopoeia of India. Manager of Publications, Govt. of India, New Delhi.

Anonymous, 1986. The Ayurvedic Pharmacopoeia of India, Part- I, Volume–I, First edition, Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 1987.The Prevention of Food Adulteration Act 1954 (Act No. 37 of 1954) and Rules. Publication Controller, Delhi.

Anonymous, 1998. The Unani Pharmacopoeia of India, Part-I, Vol.-I, Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 2008. The Siddha Pharmacopoeia of India, Part-I, Vol.-I, Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Bisset N.G, 1994.Herbal Drug and Phytopharmaceutical, Medpharm.Stuttgart.

Cromwell, B.T., 1955. In Modern methods of plant analysis Peach, K. and M.V. Tracy Vol. 4. Springer – Verlag, Heidelberg.

Evans W.C.,,1997.Trease and Evans Pharmacognosy 14th ed. W.B. Saunders Company, London.

Jackson, Betty P., Snowdon, Derekw, 1992, Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices, CBS Publisher and Distributions (P) Ltd. II. Daryaganj, New Delhi 110002. (India).

Johanson, D.A., 1940. Plant Microtechnique, Mc Graw Hill Book Co., New York.

Kapoor L.D., 1990.Hand book of Ayurvedic Medicinal plants.CRC Press.Inc., Florida.

Leug, Albert Y. and Foster, Steven, 1996. Encyclopedia of Common Natural Ingredients (use in food drugs and cosmetic), A Wiley- Interscience Publication, Johan wiley & Sons, Inc.

Pandey V.N. and Pant P.C., 1997.Med. & Aromat. Plant Abstr. 0278 (1998). Madras Agric. J.

Prajapati, Narayan Das, Purohit, S.S. and Sharma,Tarun Kr., 2003. A Hand Book of Medicinal Plant a complete source book, Agrobios (India) Agrohouse behind Nasrani Cinema Champasni Road, Jodhpur.

Rayner, R.W., 1970. A Mycological Colour Chart. Common wealth. Mycological Institute, Kew, Surrey and British Mycological Society London.

Robinson, T., 1963. The organic constituents of higher plants, Burgus Publishing Co., U.S.A.

Shah, C.S. and Qudry, J.S., 1990-91. Pharmacognosy. B.S. Shah Peakashan 1183. Pankore Naka, Ahmadabad.

Sharma, P.C., Yelne, M.B. and Dennis T.J., 2002. Medicinal Plants Used in Ayurveda. Central Council for Research in Ayurveda and Siddha, New Delhi.

Shellared, E.J., 1968. Quantitative paper and thin-layer chromatography. Academic Press, London.

Smith, I. and Feinberg J.G., 1972. Paper chromatography, Thin layer chromatography and Electrophoresis. Longmans, London.

Stahl, E., 1969. Thin-layer Chromatography. A Laboratory Hand book. Translated by M.R.F. Ashworth. Allen and Unwin, London.

Trease, G.E. and Evans, W.C., 1972. Pharmacognosy 10th edn. Edn. Bailliere Tindel, London.

Trease, G.E. and Evans, W.C., 1978. Pharmacognosy 11th edn. Edn. Bailliere Tindel, London.

Willard, H.H.; Merrit, L.L. and Dean J.A., 1965. Instrumental methods of analysis, 4th edn. Affiliated East-West Press, Pvt. Ltd., New Delhi.

Youngken, H.W., 1951. Pharmaceutical Botany, 7th ed., The Blackistan Company, Toronto.

Ethnoveterinary Uses of Plants for Injuries in Central Himalaya: A Review

[1]*Lalit Tiwari, [2]Nitin Rai,
[1]Rajeev Kr. Sharma and
[3]P. C. Pande

1. Homoeopathic Pharmacopoeia Laboratory, Kamla Nehru Nagar, Ghaziabad (U.P.)

2. Department of Botany, M.M.H. College, Ghaziabad (U.P.)

3. Department of Botany, S.S.J. Campus, Kumaun University, Almora (Uttarakhand)

Abstract

Central Himalaya is very rich in traditional knowledge. Ethnic people and tribes of Central Hiamlaya are practicing traditional practices against various animal diseases and disorders. This traditional information were transmitted by word of mouth from one generation to next generation. Due to modernization, this valuable information are vanishing very rapidly. Therefore, there is an urgent need to document this empirical knowledge. Present paper deals with ethnopharmacological attributes of 100 plants which are used in treatment of various injuries in animals and suggests their phytochemical and pharmacological investigations to validate such claims.

Key words: Ethnoveterinary, Central Himalaya, Injuries.

Introduction

Diseases and disorders are basic problems for both the human beings and animals. Living beings have always been fighting with diversified types of injuries like bone fracture, burns, wounds, cuts, broken horns, etc. since prehistoric periods. Livestock keepers who live close to their animals often have detailed information on various injuries, their causes and control. Treatments of animal injuries are differing widely across societies, and even within a single community among gender, age, education, and caste. Women are keen observers of injuries effecting cattle, due to their association with milking and have knowledge about problems related to lactation, milk letdown, milk quality, etc. (Tiwari and Pande, 2010).

Present investigation deals with the uses of plants to cure internal and external injuries in Central Himalaya region. The Central Himalayan Region covers the new state of Uttarakhand (embodying the Kumaon and Garhwal), which came into existence on November 9, 2000 as the 27th state of India, is bounded by China (Tibet) on the north, Nepal on the east, Uttar Pradesh on the south and Himanchal Pradesh on the north-west and lies between 28° 53' 24" and 31° 27' 50" N latitude and between 77° 34' 27" and 81° 02' 22" E longitudes. In Uttarakhand Himalaya, livestock occupies a very important place in human life. It is an integral part of agriculture-based economy of Uttarakhand. More than 70% of the rural population of Uttarakhand Himalaya depends upon animals for their economic needs. In this region, every land-cultivating house, attempts to

*Author for correspondence

maintain a pair of bullocks for ploughing purpose, a cow and a buffalo for milk and calves for replacement of bullocks. In remote and higher altitude regions, the people are also maintaining sheep for wool and horses/mules for transport purpose (Tiwari and Pande, 2011). The people of Uttarakhand most commonly use surrounding resources like plants, plants parts, animal parts, minerals, etc. to cure internal and external injuries.

Methodology

Extensive field and published literature surveys were made in the Uttarakhand Himalaya during 2008 to 1011 to collect the desired information (Gaur *et. al*., 1992, Samal *et. al*., 2002 and 2003, Tiwari and Pande, 2004; Bisht *et. al*., 2004, Tiwari and Pande, 2005; Pande *et. al*., 2006, Tiwari and Pande, 2006; Tiwari and Pande, 2006a; Tiwari and Pande, 2006b; Shah *et. al*., 2007 ; Tiwari *et. al*. 2007 ; Pande *et. al*. 2007; Shah *et. al*., 2008 ; Tiwari and Pande, 2009, Tiwari and Pande, 2010; Tiwari and Pande, 2011, Tiwari *et. al*. 2011 and Agnihotri *et. al*., 2012). During the survey, data were gathered from the knowledgeable persons who practice and had experience about animal husbandry and veterinary medicines. The information was further verified by cross checking from different aged men and women. Voucher specimens are preserved in Kumaon University, S.S.J Campus, Almora. The folklore data, presented plant-wise (table 1) include botanical and vernacular names of plants followed by part used and their application.

Results and Conclusions

Present study deals with a total of 100 medicinal plants which are used by people of Central Himalaya to cure various internal and external injuries. Out of 100 plants; 47 plant species are used to cure bone fracture; 47 to cure wounds; 17 in the treatment of broken horns, 12 to cure internal injuries like sprain, swelling, etc.; 10 to cure cuts and 2 in the treatment of burn by ethnic people and tribals of Central Himalaya (Figure 1). This documentation of plants and their uses in various internal and external injuries are very useful to inventing new promising pharmaceuticals in the field of veterinary medicines reward.

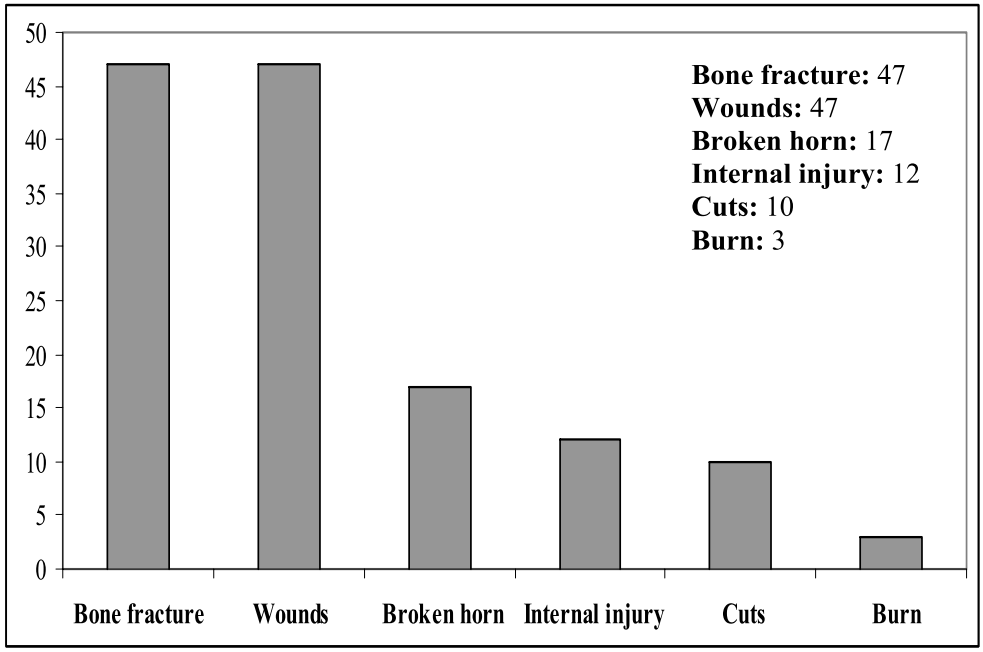


Fig. 1: Plant used in various internal and external injuries

Table-1: Plants used to cure injuries

Sl. No.	Name of Plant	Family	Vernacular Name	Plant Part	Disorders
1.	*Acorus calamus* L.	Araceae	Boja	Rhizome	Wounds
2.	*Agave americana* L.	Agavaceae	Ram-bansh	Leaf	Bone fracture, broken horn
3.	*Ajuga bracteosa* Wall. ex Benth	Lamiaceae	Ratpatti	Whole plant	Wounds
4.	*Anemone vitifolia* Buch.-Ham. ex DC.	Ranunculaceae	Mudeela	Root	Broken horn, wounds
5.	*Artemisia roxburghiana* Wall. ex Bess.	Asteraceae	Kunjaa	Leaf	Wounds, cuts
6.	*Azadirachta indica* A. Juss.	Meliaceae	Nim	Leaf	Broken horn, burn
7.	*Barleria cristata* L.	Acanthaceae	Catserna	Leaf	Wounds
8.	*Bauhinia variegata* L.	Caesalpiniaceae	Kwairare	Bark	Internal injury
9.	*Berberis aristata* DC.	Berberidaceae	Kashmoi	Stem	Wounds

Sl. No.	Name of Plant	Family	Vernacular Name	Plant Part	Disorders
10.	*Berberis asiatica* Roxb. ex DC.	Berberidaceae	Kilmodu	Stem	Wounds
11.	*Bergenia ligulata* (Wall.) Engler	Saxifragaceae	Silpadi	Rhizome	Bone fracture, wounds
12.	*Betula alnoides* Buch.-Ham. ex D. Don.	Betulaceae	Katbhoj	Bark	Wounds
13.	*Betula utilis* D. Don	Betulaceae	Bhooj	Stem	Internal injuries, wounds, cuts
14.	*Boehmeria macrophylla* Hornem.	Urticaceae	Aanch	Bark	Bone fracture
15.	*Bombax ceiba* L.	Bombacaceae	Semal	Bark	Bone fracture, broken horn
16.	*Boschniakia himalaica* Hook. f. & Thoms. ex Hook. f.	Orobanchaceae	Ganelu	Whole plant	Wounds, cuts, broken horn
17.	*Brassica campestris* L.	Brassicaceae	Sarson	Seed	Bone fracture, burn, cuts
18.	*Buxus wallichiana* Baill.	Buxaceae	Papari	Bark	Bone fracture
19.	*Caltha palustris* L.	Ranunculaceae	Kushnya	Root	Broken horn
20.	*Canna indica* L.	Cannaceae	Kali haldi	Root	Wounds
21.	*Cannabis sativa* L.	Cannabaceae	Bhang	Leaf	Bone fracture, wounds
22.	*Carpinus viminea* Wall.	Betulaceae	Chamarmau	Bark	Bone fracture, wounds
23.	*Caryopteris odorata* (D.Don) Robinson	Verbenaceae	----------	Leaf	Bone fracture
24.	*Chenopodium album* L.	Chenopodiaceae	Bethuwa	Leaf	Wounds, cuts

Sl. No.	Name of Plant	Family	Vernacular Name	Plant Part	Disorders
25.	*Cinnamomum tamala* Nees ex Eberm.	Lauraceae	Kirkiria	Bark	Broken horn
26.	*Cirsium verutum* (D.Don) Sprenge.	Asteraceae	Biskanara	Root	Wounds
27.	Coelogyne cristata Lindl.	Orchidaceae	Harjojan	Whole plant	Bone fracture, internal injury
28.	Colebrookea oppositifolia Sm.	Lamiaceae	Bursong	Leaf	Bone fracture
29.	*Corydalis cornuta* Royle	Fumariaceae	Balsam jar	Root	Wounds
30.	Costus speciosus (Koen. ex Retz.) Sm.	Zingiberaceae	Keol	Root	Internal injuries
31.	*Curcuma angustifolia* Roxb.	Zingiberaceae	Tikhur	Root	Bone fracture, wounds
32.	*Curcuma domestica* Vallars	Zingiberaceae	Haldi	Root	Bone fracture, broken horn, wounds
33.	*Cuscuta reflexa* Roxb.	Cuscutaceae	Agasilair	Whole plant	Bone fracture, internal injury
34.	*Cynodon dactylon* (L.) Pers.	Poaceae	Dub	Whole plant	Bone fracture, Internal injury, broken horn
35.	*Cynoglossum zeylanicum* (Vahl. ex Hornem.) Thunb. ex Lehm.	Boraginaceae	Chitkari	Leaf	Wounds
36.	*Debregeasia longifolia* (Burm. f.) Wedd.	Urticaceae	Tusara	Stem	Bone fracture
37.	*Debregeasia salicifolia* (D. Don.) Rendle	Urticaceae	Syanru	Stem	Bone fracture

Sl. No.	Name of Plant	Family	Vernacular Name	Plant Part	Disorders
38.	Dendrobium amoenum Wall. ex Lindl.	Orchidaceae	Harjojan	Whole plant	Bone fracture
39.	Dendrocalamus strictus (Roxb.) Nees	Poaceae	Bans	Wood	Bone fracture
40.	*Drimia indica* (Roxb.) Jessop.	Liliaceae	Pinnar	Bulb	Bone fracture, wounds
41.	*Echinochloa frumentacea* (Roxb.) Link	Poaceae	Madira	Seed	Bone fracture
42.	*Eclipta prostrata* (L.) L.	Asteraceae	Bhangru	Root	Wounds
43.	*Eupatorium adenophorum* Spreng.	Asteraceae	Kharna	Leaf	Wound, cut
44.	Euphorbia pilosa L.	Euphorbiaceae	Chuplya	Latex	Wounds, cuts
45.	*Fagopyrum esculentum* (L.) Moench.	Polygonaceae	Ugal	Root	Internal injuries
46.	*Ficus palmata* Forssk.	Moraceae	Beru	Latex	Wounds
47.	*Ficus sarmentosa* Buch.-Ham. ex Sm.	Moraceae	Beduli	Bark	Bone fracture
48.	*Filipendula vestita* (Wall. ex G.Don) Maxim.	Rosaceae	----------	Leaf	Wounds
49.	Galinsoga parviflora Cav.	Asteraceae	Khusari-gha	Whole plant	Wounds
50.	*Geranium wallichianum* D.Don. ex Sweet.	Geraniaceae	Neenai	Root	Bone fracture
51.	*Girardinia diversifolia* (Link) Fries.	Urticaceae	Kandeli-marsu	Root	Bone fracture
52.	*Grewia optiva* J.R. Dumm. ex Burrett	Tiliaceae	Bhimal	Bark	Bone fracture

Sl. No.	Name of Plant	Family	Vernacular Name	Plant Part	Disorders
53.	Gymnadenia orchidis Lindl.	Orchidaceae	----------	Root	Wounds, cuts
54.	*Hypericum oblongifolium* Choisy	Hypericaceae	Peoli	Whole plant	Wounds
55.	*Juglans regia* L.	Juglandaceae	Akhod	Bark	Bone fracture, broken horn
56.	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Kalmina	Root	Bone fracture
57.	*Lantana camara* L.	Verbenaceae	Kuri-ghas	Leaf	Wounds
58.	*Lens culinaris* Medik.	Fabaceae	Masoor	Seed	Broken horn
59.	*Litsea glutinosa* (Lour.) Robinson.	Lauraceae	Chandna	Bark	Bone fracture
60.	*Litsea monopetala* (Roxb.) Pers.	Lauraceae	Katmara	Bark	Bone fracture
61.	Luisia trichorhiza (Hook.) Blume	Orchidaceae	----------	Root	Bone fracture
62.	*Micromeria biflora* (Buch.-Ham. ex D. Don) Benth.	Lamiaceae	Garur-buti	Whole plant	Wounds
63.	*Morina longifolia* Wall. ex DC.	Morinaceae	Bishkandara	Root	Wounds
64.	*Myrica esculenta* Buch.-Ham. ex D. Don	Myricaceae	Kaphal	Bark	Bone fracture
65.	*Neolitsea pallens* (D. Don) Momiyana & Hara	Lauraceae	Cirar	Seed	Wounds
66.	*Nicotiana tabacum* L.	Solanaceae	Tamakhu	Leaf	Wounds
67.	*Ocimum tenuiflorum* L.	Lamiaceae	Tulasi	Leaf	Wounds
68.	Oryza sativa L.	Poaceae	Dhan	Seed	Bone fracture
69.	*Paris polyphylla* Sm.	Liliaceae	Satwa	Rhizome	Wounds

Sl. No.	Name of Plant	Family	Vernacular Name	Plant Part	Disorders
70.	*Parthenocissus semicordata* (Wall.) Planch.	Vitaceae	Dhyar-lagul	Stem	Bone fracture
71.	*Pinus roxburghii* Sarg.	Pinaceae	Sowl, Kulain	Resin	Bone fracture, broken horn
72.	*Pinus wallichiana* A.B. Jackson	Pinaceae	Chir	Bark	Bone fracture
73.	Piper longum L.	Piperaceae	Pipli	Root	Internal injury, wounds
74.	*Prunus cerasoides* D.Don	Rosaceae	Paya	Resin	Bone fracture
75.	*Prunus persica* (L.) Betsch.	Rosaceae	Aaru	Leaf	Wounds
76.	*Pyracantha crenulata* (D.Don.) M. Roem.	Rosaceae	Ghingharu	Leaf	Burn
77.	*Pyrus pashia* Buch.-Ham. ex D.Don.	Rosaceae	Mehal	Fruit	Bone fracture
78.	*Quercus leucotrichophora* A. Camus	Fagaceae	Banj	Bark	Bone fracture, broken horn, internal injury
79.	*Quercus semecarpifolia* Sm.	Fagaceae	Banj	Bark	Bone fracture
80.	*Reinwardtia indica* Dumort.	Linaceae	Basant	Leaf	Wounds, cuts
81.	*Rheum australe* D.Don	Polygonaceae	Archa	Root	Bone fracture, cuts, wounds, internal injury, broken horn
82.	*Rumex hastatus* D.Don	Polygonaceae	Almoru	Whole plant	Wounds
83.	*Saccharum officinarum* L.	Poaceae	Ganna	Stem	Wounds

Sl. No.	Name of Plant	Family	Vernacular Name	Plant Part	Disorders
84.	*Schleichera oleosa* (Lour.) Oken.	Sapindaceae	Kusum	Seed	Wounds
85.	*Senecio graciliflorus* DC.	Asteraceae	Kikret	Whole plant	Wounds
86.	*Styrax benzoin* Dryand	Styracaceae	----------	Leaf	Bone fracture
87.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Jamun	Bark	Internal injury
88.	*Tagetes erecta* L.	Asteraceae	Hajari	Whole plant	Broken horn
89.	*Tamarindus indica* L.	Caesalpiniaceae	Imli	Bark	Wounds
90.	*Taxus baccata* L. subsp. *wallichiana* (Zucc.) Pilger	Taxaceae	Thuner	Bark	Bone fracture
91.	*Trichosanthes bractreata* (Lam.) Voigt.	Cucurbitaceae	Indrain	Stem	Wounds
92.	*Tridax procumbens* L.	Asteraceae	Kateri	Whole plant	External injury
93.	*Ulmus wallichiana* Planch	Ulmaceae	Chamrua	Bark	Bone fracture
94.	*Urtica ardens* Link	Urticaceae	Kandali	Leaf	Bone fracture
95.	*Urtica dioica* L.	Urticaceae	Bhicchughas	Whole plant	Wounds, internal injury
96.	*Vanda cristata* Lindl.	Orchidaceae	Harjojan	Whole plant	Bone fracture
97.	*Vigna mungo* (L.) Hepper.	Fabaceae	Mash	Seed	Bone fracture
98.	*Vigna radiata* (L.) R. Wilczek	Fabaceae	Moong	Seed	Bone fracture, broken horn
99.	Ziziphus mauritiana Lam.	Rhamnaceae	Ber	Root	Wounds, cuts
100.	Ziziphus nummularia (Burm.f.) Wight & Arnott.	Rhamnaceae	Ber	Leaf	Broken horn

Using splints of *Dendrocalamus strictus* for give support during bone fracture in calf

Wound in the chin of horse

Acorus calamus

Colebrookea oppositifolia

Debregeasia salicifolia

Ficus palmata

Myrica esculenta

Acknowledgements

The authors are very thankful to all research workers whose published works are used in this article. The cooperation extended by local healers or knowledgeable persons of the study area is gratefully acknowledged.

References

Agnihotri, A. K., Tiwari, Lalit, Rai, Nitin, Sharma, Rajeev Kr. and Sikarwar, R. L. S., 2012. Traditional Healthcare Uses of Wild Plants prevalent in Haldwani Forest Area, Central Himalaya. *Res. & Rev.: J. Phar. Sci. Tech*. (in press)

Bisht, Nisha, Pande, P. C. and Tiwari, Lalit, 2004. Ethno-veterinary practices of Kapkot block of Bageshwar district, Uttaranchal. *Asian Agri-History* 8(4): 209-314.

Gaur, R. D., Bhatt, K.C. and Tiwari. J. K., 1992. An ethnobotanical study of Uttar Pradesh Himalaya in relation to veterinary medicines. *J. Indian bot. Soc.* 72: 139-144.

Pande, P. C., Lalit Tiwari and H. C. Pande, 2006. *Folk Medicine and Aromatic Plants of Uttaranchal Himalaya*. Bishen Singh Mahendra Pal Singh, Dehradun, India.

Pande, P. C., Tiwari, Lalit and Pande, H. C., 2007. Ethnoveterinary plants of Uttaranchal-A review. *Indian Journal of Traditional Knowledge* 6(3): 444-458.

Samal, P. K. and Anubha Shah, Sushil Tiwari, Bhupender Mehara and D. V. Agrawal, 2003. Indigenous animal health care practices in India Central Himalaya: Empirical evidences. *Indian Journal of Traditional Knowledge* 2(1): 40-50.

Samal, P. K., Anubha Shah, S. C. Tewari and D. K. Agrawal, 2002. Indiginous animal health care practices and their relevance to bioresources conservation in Indian Central Himalaya. *Interational J. Sustain. Dev. World Ecol*. 8: 167-178.

Shah, Rohita, Pande, P. C. and Tiwari, Lalit, 2007. Folklore biomedicine for some veterinary diseases and disorders in Western part of Almora District. In: Traditional Knowledge Systems and Archaeology with Special Reference to Uttarakhand (Ed. D.P. Agrawal, Manikant Shah and Sameer Jamal). Aryan Books International, New Delhi.

Shah, Rohita, Pande, P. C. and Tiwari, Lalit, 2008. Traditional veterinary herbal medicines of western part of Almora district, Uttarakhand Himalaya. *Indian Journal of Traditional Knowledge* 7(2): 355-359.

Tiwari, Lalit and Pande, P. C. (2010). Himalayan medicine system and its Ayurvedic perspectives. *Asian Agri-History* 14(3): 261-272.

Tiwari, Dolly, Pande, P. C. and Tiwari, Lalit, 2007. Ethno-veterinary herbal medicines of Dwarahaat area of Uttaranchal Himalaya. *Indian Forester* 133: 379-390.

Tiwari, Lalit and Pande, P. C., 2004. Traditional veterinary practices in south-eastern part of Chamoli district, Uttaranchal. *Indian Journal Traditional Knowledge* 3(4): 397-406.

Tiwari, Lalit and Pande, P. C., 2005. Traditional Veterinary Medicinal Plants of Bhilangana Valley of Tehari district, Uttaranchal Himalaya. *Asian Agri History* 9(3): 253-262.

Tiwari, Lalit and Pande, P. C., 2006. Ethno-veterinary medicines of holy Doonagiri hills of Uttaranchal. *Journal Economic and Taxonomic Botany* 30: 151-162.

Tiwari, Lalit and Pande, P. C., 2006a. Indigenous veterinary practices of Darma valley of Pithoragarh district, Uttaranchal Himalaya. *Indian Journal Traditional Knowledge* 5(2): 201-206.

Tiwari, Lalit and Pande, P. C., 2006b. Ethnoveterinary plants of Uttarkashi district, Uttaranchal, India. *Ethnobotany* 18(1&2): 139-144.

Tiwari, Lalit and Pande, P. C., 2009. Ethnoveterinary Plants of Johar Valley of Pithoragarh district, Uttaranchal Himalaya. VEGETOS 22(1): 55-62.

Tiwari, Lalit and Pande, P.C., 2010. Ethnoveterinary Medicines in Indian Perspective: Reference to Uttarakhand Himalaya. *Indian Journal Traditional Knowledge* 9(3): 611-617.

Tiwari, Lalit and Pande, P.C., 2011. Traditional animal husbandry practices of Central Himalaya. *Asian Agri-History* 15(4): 263-282.

Tiwari, Lalit, Sharma, Rajeev Kr., Amminuddin and Pande, P. C., 2011. Notes on therapeutic potential of Unani medicinal plants in ethnoveterinary medicine. *Hippocratic Journal of Unani Medicine* 6(4): 131-144.

Growth Study of *Achyranthes aspera* Linn. Under the Impact of Industrial Effluents

***Kavita Tyagi[1], Sandhya Sharma [2], Rajat Rashmi [3] and Sadia Ayub[4]**

[1]National Medicinal Plants Board (Deptt. of AYUSH, Ministry of Health & Family Welfare, Govt. of India), Chandralok Building, 36 Janpath, New Delhi- 110001.

[2]Department of Botany, M.M.H.College, Ghaziabad – 201001, India.

[3]Homoeopathic Pharmacopoeia Lab. (Ministry of Health and Family Welfare, Govt. of India), PLIM Building, Ghaziabad 201001, U.P.

[4]Central Council for Research in Unani Medicine, 61-65 Institutional Area, Janakpuri, New Delhi-110058

Abstract

The Industrial scenario of Ghaziabad in Western UP on the eastern side of river Yamuna and nearby Hindon River is posing serious concern to the environment. In the vicinity of industries, many important plants are found growing which are medicinally important. The effluents of industries have not only changed the morphology of plants but also their therapeutic properties. Therefore, an attempt has been made for comparative growth study of *Achyranthes aspera* Linn. under the impact of industrial effluents from three industries. The plant commonly known as Latjira, belongs to family Amaranthaceae, is a 1-3 m high, stiff, erect herb, commonly found as a weed throughout India upto 3000 ft. It is much valued in indigenous medicine. This is an important plant of Siddha and Ayurveda. For this investigation, three major industrial sites of Ghaziabad viz. Atlas Cycle Industry, Ester -India Chemicals and Magnum Paper Mill and apparently non polluted areas of villages Bayana and Dasana in district Ghaziabad, U.P. and ALTT Centre, Ghaziabad were selected.

In this study various growth parameters like height of plants, shoot length, root length and number of leaves/ plant were observed in industrial and controlled area. Results show a mark reduction in all the growth parameters studied but plants respond differentially in different industrial effluents.

Key Words : Growth parameters, *Achyranthe aspera*, Effluent analysis.

Introduction

A survey of Ghaziabad district indicates that most of the industries are situated close to the populated area and agricultural land. The industrial wastes are being discharged in the nearby rivers and streams through the discharged channels of factories, inspite of Pollution Control Acts in practice. The pollution in the region has mercilessly affected the growth of various plant species having substantial medicinal value.

The industrialization has adversely affected the growth and quality of medicinal plants. Therefore, an attempt has been made to undertake the study on impact of industrial pollution on the growth of *Achyranthes aspera* Linn., a medicinal plant abundantly growing in the polluted areas of Sahibabad, Trans Hindon Industrial areas and non-polluted areas of villages Bayana and Dasana in district Ghaziabad, U.P. and ALTT Centre, Ghaziabad. The plant is used as one of the ingredients in the “Siddha” preparation of “Naaga Parpam” and

*Author for correspondence

"Naaga Chendooram". Seeds contain mainly saponin a and b, hentriacontane, alkaloid, oleanolic acid, saponin and achyranthine. Plant is a pungent and laxative and used in piles, boils eruptions of the skin *etc* (Joshi, 2000). In this study various growth parameters like height of plants, shoot length, root length and number of leaves/ plant have been studied in industrial and controlled areas and observations recorded.

Materials and Methods

Monthly visits were made to Sahibabad industrial area (polluted area) for one year (2002-2003) where Magnum Paper Mill Industry, Atlas Cycle Industry and Ester - India Chemicals are located. Village Bayana and Dasana in Distt. Ghaziabad, U.P. and ALTT Centre were taken as non polluted areas for study of *Achyranthes aspera*. Plants of same height and age (approx.) were selected from both the sites. The non–polluted areas of the present study were 3-4 km away from the industrial area. Meteorology and soil conditions of both the areas are similar. The plants were observed every month for one to two years from the area near sites and to study the effect of industrial effluent. The length of plant, root and shoot length, number of leaves per plant, leaf size, petiole size, lamina size etc. were studied.

The standard methods of APHA (1981) and Trivedi and Goel (1986) were followed for different analysis of effluents of the selected industries.

Results and Discussion

Analysis of effluents : Table 1 shows analysis of effluents differ significantly from each other in their colour, pH and generally having appreciably high total solids, total dissolved solids, suspended solids, BOD, COD, total heavy metal contents and organic matters. Magnum Paper Mill Industry effluents have the highest values for pH, odour, total solids, total dissolved solids, suspended solids, BOD, COD, while Atlas Cycle Industry effluent possess highest amount of heavy metals and Ester -India Chemicals contains some organic matters.

Growth studies: The various growth parameters such as height of plants (shoot, root length) and number of leaves/ plants were studied in industrial and non-polluted areas (**Fig. 1-3**). Results show a mark reduction in all the growth parameters studied but plant respond differentially in different industrial effluents. However, there are no major changes in the growth of root and shoot length of plants during the month of October to December at both sites. The results are tabulated in **table 2, 3 and 4.**

Studied growth parameters such as shoot length, root length and number of leaves / plants were decreased in all the plant samples collected from polluted areas. The results obtained in the present study indicated that the pollutants which were emerging out with industrial effluents cause a serious problem to other nearby growing medicinally important plants. In a similar study, Gupta (1981) reported that *Solanum melongena* which was affected badly by the air pollutants in the vicinity of the power plant complex resulted in poor growth and reduced productive capacity. The studies of Mhatre (1980), Asthana (1988) are also in agreement with present findings. Srivastava and Renu (1988) analyzed the physico–chemical and biological characteristics of sugar factory effluent. They found that these effluents not only endanger the existence of aquatic life but also decrease the productive potential of natural water bodies and make water unfit for irrigation, bathing and drinking.

The plants growing in the vicinity of polluted water released by Paper Mill were actually under stress and have not shown any visible symptoms of injury but there are certain invisible symptoms which were measurable in terms of their various growth parameters. The growth study of *Achyranthes aspera* Linn. in the present investigation is in agreement with Pande and Rao (1978); Ghouse and Khan (1984); Salgare and Andhyrarujina (1987, 1988); Gawde (1988); Tripathy and Sahu (1997) and Salgare and Acharekar (2000).

Conclusion

The present study showed that the effluent of all the three selected industries adversely affects the growth of the plants. So it can be suggested that the effluent of these industries should not be used for irrigation at any dilution. Further, the medicinal plants, which are growing in the vicinity of these industries, should not be used for the preparation of medicines, and effluents should be properly treated or recycled before their disposal.

Table-1: Growth parameters of *Achyranthes aspera* Linn. observed under the influence of Magnum Paper Mill Effluent.

Sl. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
1.	Jan.	6.77 + 0.74 CV = 10.93	4.94 + 0.98 CV = 1.99	3.99+ 0.49 CV = 12.56	3.10 + 0.46*** CV = 15.33	51.00 + 0.08 CV = 1.56	19.00 + 0.66** CV = 3.47
2.	Feb.	6.98 + 0.36 CV = 5.15	5.34 + 0.22** CV = 4.11	4.89 + 0.68 CV = 13.91	3.68 + 0.79 CV = 21.46	58.00+ 0.75 CV = 1.29	17.2 + 1.80*** CV = 6.26

Sl. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
3.	Mar.	7.72 + 0.48 CV = 6.21	5.39 + 0.38** CV = 7.05	5.31 + 0.39 CV = 7.34	4.31 + 0.29*** CV = 6.72	63.80 + 0.45 CV = 0.79	52.60 + 0.75* CV = 1.42
4.	Apr.	8.19 + 0.11 CV = 1.34	6.12 + 0.98*** CV = 1.60	6.89 + 0.45 CV = 6.53	5.89 + 0.38*** CV = 5.10	68.00 + 0.77 CV = 1.13	54.00 + 0.76* CV = 1.40
5.	May	7.68 + 0.38 CV = 4.94	6.89 + 0.29 CV = 4.21	7.89 + 0.39 CV = 4.94	5.12 + 0.30* CV = 5.85	67.20 + 0.27 CV = 0.40	64.00 + 0.93 CV = 1.43
6.	Jun.	8.83 + 1.35 CV = 15.28	7.63 + 1.89 CV = 24.86	8.02 +s 0.32 CV = 3.99	7.39 + 0.40 CV = 5.41	72.80 + 35.66 CV = 0.91	69.00 + 0.12 CV = 0.17
7.	Jul.	9.39 + 1.80 CV = 19.17	8.03 + 1.39 CV = 17.31	8.92 + 0.49 CV = 5.55	7.99 + 0.29 CV = 3.62	83.80+ 0.10 CV = 0.12	70.00 + 0.50* CV = 0.71
8.	Aug.	13.77 + 0.54 CV = 3.19	11.94 + 0.18*** CV = 1.50	9.60 + 0.49 CV = 5.10	8.50 + 0.86 CV = 10.11	95.00 + 0.33 CV = 0.35	75.00 + 0.60* CV = 0.80
9.	Sept.	19.70 + 0.81 CV = 4.12	11.61 + 0.68* CV = 0.58	15.00 + 1.09 CV = 0.93	10.5 +0 .50*** CV = 14.28	80.00 + 0.14 CV = 0.18	78.40 + 0.50 CV = 0.64
10.	Oct.	20.80 + 0.86 CV = 4.13	11.71+ 0.92* CV = 7.92	20.50 + 0.63 CV = 3.07	17.50 + .80*** CV = 4.57	132.80+0.18 CV = 0.14	99.40 + 0.31* CV = 0.32
11.	Nov.	21.80 + 1.93 CV = 8.86	13.68 +0.63*** CV = 4.60	23.12 + 0.89 CV = 3.84	18.86+ 0.92*** CV = 4.93	212.7 + 1.62 CV = 0.76	122.60 + 1.93* CV = 1.57
12.	Dec.	22.5 + 0.98 CV = 4.35	14.76 + 0.39** CV = 2.64	25.39 + 0.38 CV = 1.49	20.83 + 0.80** CV = 3.84	210.0 + 1.69 CV = 0.80	109.0 + 1.87 CV = 1.77

Significant at 0.1% --*; 1.0% -- **; 5.0% -- ***

Table-2: Growth parameters of *Achyranthes aspera* Linn. observed under the influence of Atlas Cycle Industry Effluent.

Sl. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
1.	Jan.	6.72 + 0.73 CV = 10.86	4.91+ 0.21 CV = 4.27	4.99+ 0.29 CV = 5.81	4.10 + 0.56*** CV = 13.65	48.00 + 0.09 CV = 0.18	18.00 + 0.76** CV = 4.22

Sl. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
2.	Feb.	6.80 + 0.36 CV = 5.29	5.24 + 0.22** CV = 4.19	5.50 + 0.68 CV = 12.36	3.25 + 0.69 CV = 21.23	52.00+ 0.71 CV = 1.36	16.15 + 1.90*** CV = 11.76
3.	Mar.	7.22 + 0.48 CV = 6.64	5.19 + 0.28** CV = 5.39	6.00 + 0.39 CV = 6.5	4.31 + 0.29*** CV = 6.72	63.80 + 0.45 CV = 0.70	52.60 + 0.75* CV = 1.42
4.	Apr.	8.19 + 0.11 CV = 1.34	6.12 + 0.28*** CV = 4.57	6.22 + 0.15 CV = 2.41	5.39 + 0.38*** CV = 7.05	61.00 + 0.97 CV = 1.59	51.00 + 0.26* CV = 0.51
5.	May	6.16 + 0.18 CV = 2.92	5.29 + 0.19 CV = 3.59	6.82+ 0.19 CV = 2.78	5.45 + 0.40* CV = 7.33	62.20 + 0.27 CV = 0.43	54.00 + 0.13 CV = 0.24
6.	Jun.	8.63 + 1.35 CV = 15.64	7.23 + 1.89 CV = 26.14	7.02 + 0.32 CV = 4.55	6.09 + 0.20 CV = 3.28	68.20 + 5.66 CV = 8.30	62.00 + 0.22 CV = 0.35
7.	Jul.	9.29 + 1.80 CV = 19.37	8.13 + 1.29 CV = 15.86	8.12 + 0.59 CV = 7.26	7.20 + 0.29 CV = 4.02	72.80+ 0.30 CV = 0.41	70.00 + 0.25* CV = 0.35
8.	Aug.	12.97 + 0.24 CV = 1.85	10.2 + 0.24*** CV = 2.34	9.25 + 0.49 CV = 5.29	7.95 + 0.86 CV = 10.81	85.00 + 0.33 CV = 0.39	76.00 + 0.65* CV = 0.85
9.	Sept.	17.20 + 0.81 CV = 4.71	12.61 + 0.62* CV = 4.96	14.00 + 1.09 CV = 7.78	12.5 + 1.56*** CV = 12.48	83.00 + 0.14 CV = 0.16	75.40 + 0.50 CV = 0.66
10.	Oct.	19.20 + 0.86 CV = 4.47	10.96+ 0.92* CV = 8.39	21.50 + 0.63 CV = 2.93	16.2 + 0.80*** CV = 4.93	126.8 + 0.18 CV = 0.14	102.40 + 0.31* CV = 0.30
11.	Nov.	21.80 + 1.93 CV = 8.85	13.68+ 0.63*** CV = 4.60	23.12 + 0.89 CV = 3.85	18.8+ 0.92*** CV = 4.87	201.2 + 1.62 CV = 0.81	100.60 + 1.23* CV = 1.22
12.	Dec.	23.5 + 0.98 CV = 4.17	15.76 + 0.39** CV = 2.47	23.39 + 0.38 CV = 1.62	19.83 + 0.80** CV = 4.03	209.0 + 1.29 CV = 0.62	106.0 + 1.65 CV = 1.56

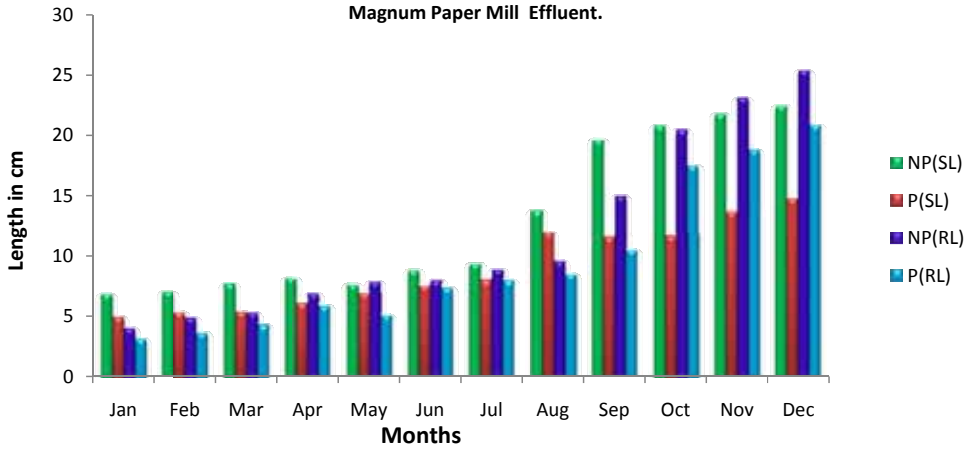
Significant at 0.1% -- * ; 1.0% -- ** ; 5.0% -- ***

Table-3: Growth parameters of *Achyranthes aspera* Linn. observed under the influence of Ester India Chemicals Effluent.

S. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
1.	Jan.	7.72 + 0.73 CV = 9.45	4.25+ 0.40 CV = 9.41	4.59 + 0.68 CV = 14.81	4.00 + 0.56*** CV = 14.00	48.00 + 0.09 CV = 0.18	17.00 + 0.56** CV = 3.29
2.	Feb.	7.80 + 0.36 CV = 4.61	5.15 + 0.12** CV = 2.33	5.31 + 0.39 CV = 7.34	4.22 + 0.69 CV = 16.35	52.00+ 0.71 CV = 1.36	16.3 + 1.50*** CV = 9.17
3.	Mar.	8.02 + 0.48 CV = 5.98	4.59 + 0.38** CV = 8.27	5.99+ 0.29 CV = 4.84	4.26 + 0.29*** CV = 6.80	63.80 + 0.45 CV = 0.70	50.60 + 0.65* CV = 1.28
4.	Apr.	8.29 + 0.11 CV = 1.32	6.10 + 0.38*** CV = 6.22	6.22 + 0.45 CV = 7.23	4.29 + 0.48*** CV = 11.18	61.00 + 0.97 CV = 1.59	50.00 + 0.16* CV = 0.32
5.	May	7.26 + 0.38 CV = 5.23	5.09 + 0.49 CV = 9.62	6.82+ 0.49 CV = 7.18	5.00 + 0.60* CV = 12.00	62.20 + 0.27 CV = 0.43	52.00 + 0.23 CV = 0.44
6.	Jun.	8.93 + 1.35 CV = 15.11	6.10 + 1.89 CV = 30.98	7.02 + 0.32 CV = 4.55	6.00 + 0.50 CV = 8.33	68.20 + 5.66 CV = 8.29	61.00 + 0.25 CV = 0.40
7.	Jul.	9.29 + 1.80 CV = 19.37	7.12 + 1.29 CV = 18.11	8.12 + 0.59 CV = 7.26	7.10 + 0.28 CV = 3.94	72.80+ 0.20 CV = 0.27	69.00 + 0.15* CV = 0.21
8.	Aug.	12.87 + 0.24 CV = 1.86	9.24 + 0.24*** CV = 2.59	9.25 + 0.49 CV = 5.29	7.55 + 0.26 CV = 3.44	85.00 + 0.33 CV = 0.38	71.00 + 0.35* CV = 0.49
9.	Sept.	17.30 + 0.81 CV = 4.68	10.51 + 0.52* CV = 4.94	14.00 + 1.09 CV = 7.78	11.5+ 1.56*** CV = 13.56	83.00 + 0.14 CV = 0.16	73.40 + 0.30 CV = 0.40
10.	Oct.	19.20 + 0.86 CV = 4.47	10.86+ 0.62* CV = 5.70	21.50 + 0.63 CV = 2.93	15.20+ 0.8*** CV = 5.26	126.8 + 0.18 CV = 0.14	95.40 + 0.41* CV = 0.42
11.	Nov.	22.80 + 1.93 CV = 8.46	12.60+ 0.53*** CV = 4.20	23.12 + 0.89 CV = 3.84	16.8+ 0.91*** CV = 5.39	201.20+ 1.6 CV = 0.80	98.60 + 1.25* CV = 1.26
12.	Dec.	24.5 + 0.98 CV = 4.00	13.76 + 0.29** CV = 2.10	23.39 + 0.38 CV = 1.62	17.82 + 0.90** CV = 5.05	209.0 + 1.29 CV = 0.61	103.0 + 1.36 CV = 1.32

Significant at 0.1% -- * ; 1.0% -- ** ; 5.0% -- ***

Figure 1: Growth studies of *Achyranthes aspera* Linn. observed under the influence of Magnum Paper Mill Effluent.



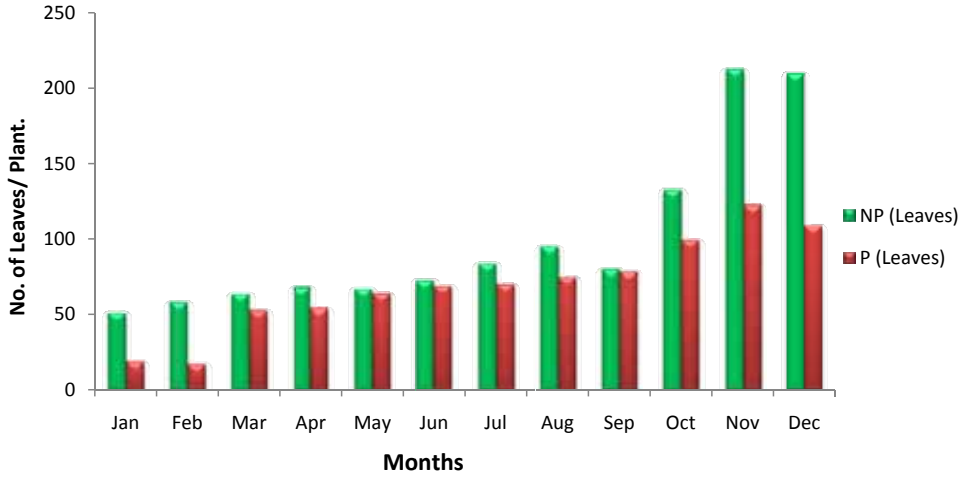
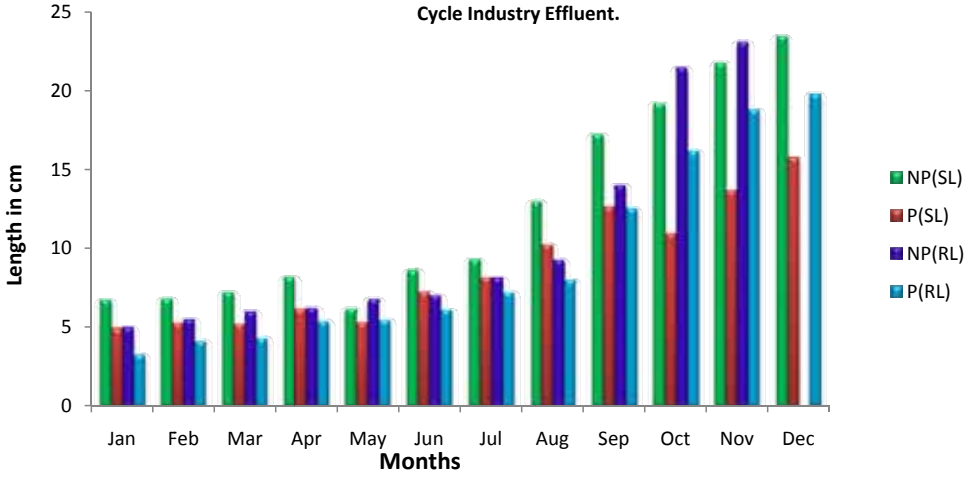


Figure 2: Growth studies of *Achyranthes aspera* Linn. observed under the influence of Atlas Cycle Industry Effluent.



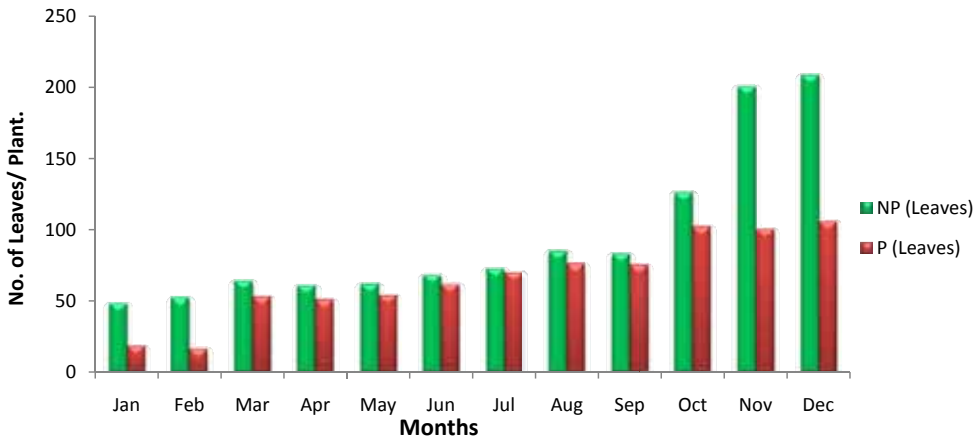
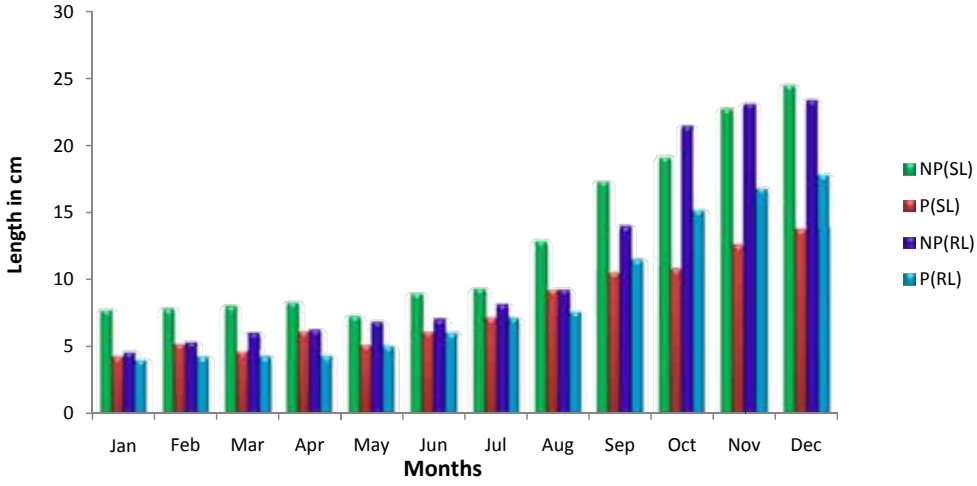
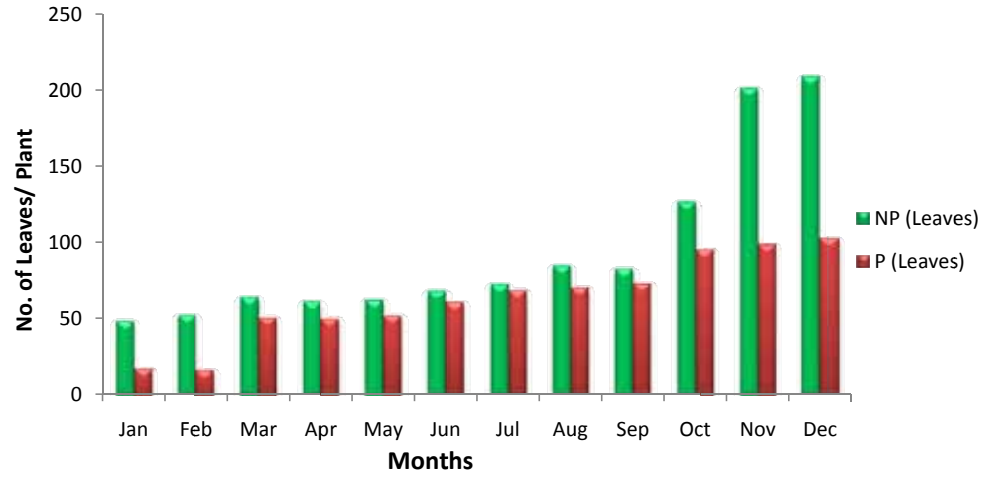


Figure 3: Growth studies of *Achyranthes aspera* Linn. observed under the influence of Ester India Chemicals Effluent.





References

Asthana, S., 1988. Effect of industrial pollutions on physiological and biochemical aspects of crops-I. *Ph.D Thesis, University of Bombay* (Accepted).

APHA, AWWA and WPCP, 1981. Standard methods for the experimental of water and wastewater, 14th ed. Amer, Publication Health Assoc. New York

Gawde, S., 1988. Effect of industrial pollution on crop physiology-I. *Ph.D Thesis University of Bombay* (Accepted).

Ghouse, A.K.M. and Khan A. Fareed, 1984. The effect of air pollutants on growth responses of *Solanum nigrum* Linn. *Acta Botanica Indica* 12: 93-94.

Gupta, M.C., 1981. Growth and reproductivity of certain vegetable crops in relation to air pollution around Kasimpur thermal power station. *Ph.D. Thesis, Aligarh* (Accepted).

Joshi, S.G., 2000. A dictionary of Indian medicinal plants, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Mhatre, G.N., 1980. Studies of plant responses, to heavy metals in industrial environment. *Ph.D. Thesis. University of Bombay* (Accepted).

Pande, J.N. and Rao, M.V., 1978. Studies of coal smoke sulfur dioxide pollution on wheat, exposure technique and correlation of morphological effect with SO_2 dose. *Indian J. Air Pollution Cont.* 1: 9 -16.

Salgare, S.A. and Andhyarujina, K.B.,1987. Effect of polluted water of Ulhas River on the growth performance of its vegetation - II *Bull. Environ. Sci.* 26-29.

Salgare, S.A. and Andhyarujina, K.B., 1988. Effect of polluted water of Ulhas River on the physiology of its vegetation – II Proc. 2nd *Nat. Symp. Ecotoxi*. 297- 296.

Salgare, S.A. and Acharekar, R.N., 2000. Effect of industrial pollution on some weeds of Kalu river. *J. Natcon.* 12(2) : 163-170.

Srivastava, A.K. and Renu, 1988. Physico-chemical and biological characteristics of a sugar factory effluent. *J. Eco. and Taxo. Botany* 15 (2): 192-193.

Tripathy, A. and Sahu, R.K., 1997. Effect of coal fly ash on growth and yield of wheat. *J. Environ. Biol.* 18(2): 131-135.

Trivedi, R.K. and Goel, P.K., 1986. Chemical and biological method for water pollution studies. *Environ Pub. Karad (India).*

Inventorization of Commercially Exploited Herbal Drugs of Central Himalaya Used in Ayurvedic, Unani, Siddha and Homoeopathic Formulations

[1]*Lalit Tiwari, [2]Nitin Rai, [3]Rajeev Kr. Sharma and [4]P.C. Pande

1. Homoeopathic Pharmacopoeia Laboratory, Kamla Nehru Nagar, Ghaziabad-201002 (U.P.)

2. Department of Botany, M.M.H. Collage, Ghaziabad-201001 (U.P.)

3. Pharmacopoeial Laboratory for Indian Medicine, Kamla Nehru Nagar, Ghaziabad-201002 (U.P.)

4. Department of Botany, S.S.J. Campus, Kumaun University, Almora (Uttarakhand)

Abstract

Present inventory deals with 337 plant species, having commercial value in domestic and international market and their utilization in various systems of medicine like Ayurveda, Siddha, Unani, Homoeopathy and, proprietary medicine.

Key words: Medicinal Plants, Ayurveda, Siddha, Unani, Homoeopathy and, Proprietary Practices.

Introduction

The Himalayas have a great wealth of medicinal plants and traditional medicinal knowledge. The Central Himalayan Region covers the new state of Uttarakhand, which includes the major divisions of Kumaon and Garhwal. This region has played a significant role in the civilizational processes of Northern India. Through the millennia different tribes and people-Protoaustroloids, Mundas, Kiratas, Mongoloids, Indo-Aryans, Khasas, Sakas and others - have been coming in and leaving their signatures and producing a mosaic of cultures. The cultural groups of the Central Himalayan Region include the Kumaonis, Garhwalis, and tribes like Bhotias, Rajis, Tharus, Boxas, Jaunsarees, which have their own different cultures, traditions, dialects, customs, etc. Thus, the Central Himalayas provide excellent opportunities for studying the Traditional Knowledge Systems (Agrawal and Kharakwal, 1998).

Like other ancient people, the Himalayan people also utilized plants and plant products for medicine. These plants were not only traded internally but also exported. For example, Kuth (*Saussurea costus*) was exported to east as is mentioned in *Atharvaveda*. Ancient Ayurvedic authors described seven varieties of *Harad*; the last variety is *chetaki*, of Himalayan origin (Tiwari and Pande, 2004).

The Garhwali ethno-archaeological literature describes the importance of plants in medicine. According to this, one has to grind *singraph* (sulphate of mercury), *pipli* (roots of *Piper longum*) and purified *meetha bish* (rhizome of *Aconitum atrox*) in an equal ratio either with juice of *Citrus aurantifolia* or *Syzygium cumini* for three days. Then prepare its pills, each pill should weigh equal to the weight of one seed of green gram *(Vigna radiata*). This drug is taken either with honey and root powder of *Piper longum* to treat phthisis; and the extract of ginger *(Zingiber officinale)* is used for the treatment of dyspepsia, rheumatism and puerperal fever (Badoni, 1989-90).

*Author for correspondence

The Indian Himalayan region alone supports about 18,440 species of plants (Angiosperms: 8000 spp., Gymnosperms: 44 spp., Pteridophytes: 600 spp., Bryophytes: 1736 spp., Lichens: 1159 spp. and Fungi: 6900 spp.) of which about 45% have medicinal properties (Singh and Hajra, 1997). According to Samant *et al*. (1998) out of the total species of vascular plants, 1748 spp. has medicinal properties. Pande *et al.* (2006) documented total 1338 ethnomedicinal plants and 364 ethnoveterinary medicinal plants from Uttarakhand Himalayan region. Region supplied more than thousands of commercially important species for various purposes like food, fodder, timber, house hold goods, medicines, etc (Agnihotri *et al*., 2012). Present study deals with the commercially important Himalayan medicinal plants and their status in various systems of medicine like Ayurveda, Siddha, Unani, Homoeopathy and, proprietary medicine.

Methodology

Extensive field cum literature survey were done during the period from 2009 to 2011 and commercial data regarding plants were obtained from the Indian local herbal markets like Kharibavri, New Delhi, Deharadun, Haridwar and Ramnagar, Uttarakhand (Rai *et al*., 2011). Plants are arranged in alphabetical with family, followed by part used in various systems of medicines, vernacular names, trade name and plant status in Ayurveda, Siddha, Unani, Homoeopathy and proprietary practices (Table 1). The utility pattern of commercial exploited herbal drugs were ascertain with the help of official formularies and pharmacopoeia of respective systems (Anonymous, 1971-2006, 1978, 1981, 1984, 1992, 1999, 2000, 2001, 2006, 2008 & 2011). The use in patent and proprietary medicines are literature survey based with the help of Ayurvedic Drug Index and therapeutic indices of different Ayurvedic, Unani, Siddha and Homoeopathic drug manufacturing companies (Anonymous, 2009).

Results and Discussion

Present study deals with a total of 337 medicinal plants which are having commercial potential in various domestic and International markets. Out of 337 plants, 290 plant species are used in Ayurvedic system of medicine, 122 plant species are used in Unani system of medicine, 115 plant species are used in Siddha system of medicine, 106 plant species are used in Homoeopathic system of medicines and 98 plant species are used under the category of proprietary medicines by various drug companies and traditional healers (Figure 1).

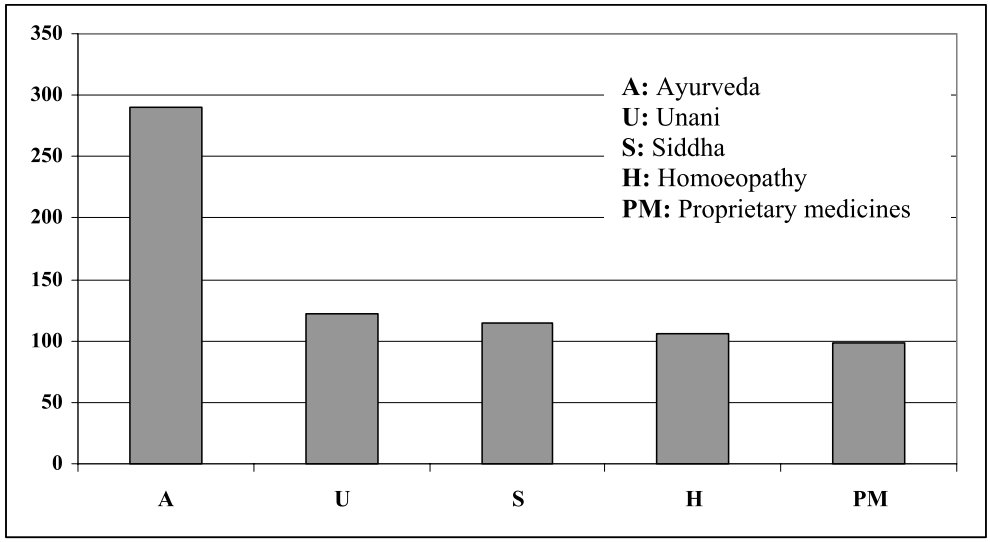


Fig. 1: Utility pattern of herbal drugs from the region in Ayurvedic, Unani, Siddha, Homoeopathic and Proprietary medicines

Of these, 24 plants species are widely used in all system of medicine: *Acorus calamus* L., *Aegle marmelos* (L.) Correa, *Allium cepa* L., *Allium sativum* L., *Asparagus racemosus* Willd., *Azadirachta indica* A. Juss., *Caesalpinia bonduc* (L.) Roxb., *Calotropis gigantea* (L.) R. Br., *Curcuma domestica* Vallars, *Eclipta prostrata* (L.) L., *Foeniculum vulgare* Mill., *Mangifera indica* L., *Mentha arvensis* L., *Ocimum basilicum* L., *Ocimum tenuiflorum* L., *Phyllanthus emblica* L., *Punica granatum* L., *Solanum nigrum* L., *Terminalia bellirica* (Gaertn.) Roxb., *Terminalia chebula* Retz., *Tinospora cordifolia* (Willd.) Miers ex Hook. f. Thoms., *Tribulus terrestris* L., *Withania somnifera* (L.) Dunal., *Zingiber officinale* Rosc. Among the different parts and products of plants used as a drug sources for various system of medicines, fruits have the highest number of species (60 species), followed by roots of 58 species; leaves of 57 species; seeds of 56 species; whole plant of 55 species; bark of 26 species; flowers of 15 species; rhizome of 11 species; stem and wood of 10 species; tubers of 8 species; resin of 4 species and bulbs of 3 species (Figure 2).

Among the genera, *Solanum* (6 spp.) had the highest number of commercially potential species, followed by *Aconitum, Allium*, *Citrus, Ocimum* and *Terminalia* (all 4 species.); *Acacia, Amaranthus, Artemisia, Asparagus, Bauhinia, Cassia, Cucumis, Curcuma, Datura, Dioscorea, Ficus, Prunus* and *Sida* (3 species); *Angelica, Berberis, Bergenia, Brassica, Calotropis, Cinnamomum, Clerodendrum, Dalbergia, Hedychium, Ipomoea, Leucas, Luffa, Mentha, Phyllanthus, Pinus, Polygonatum, Premna,* Rubus, *Smilax, Swertia* and *Valeriana* (all 2 species).

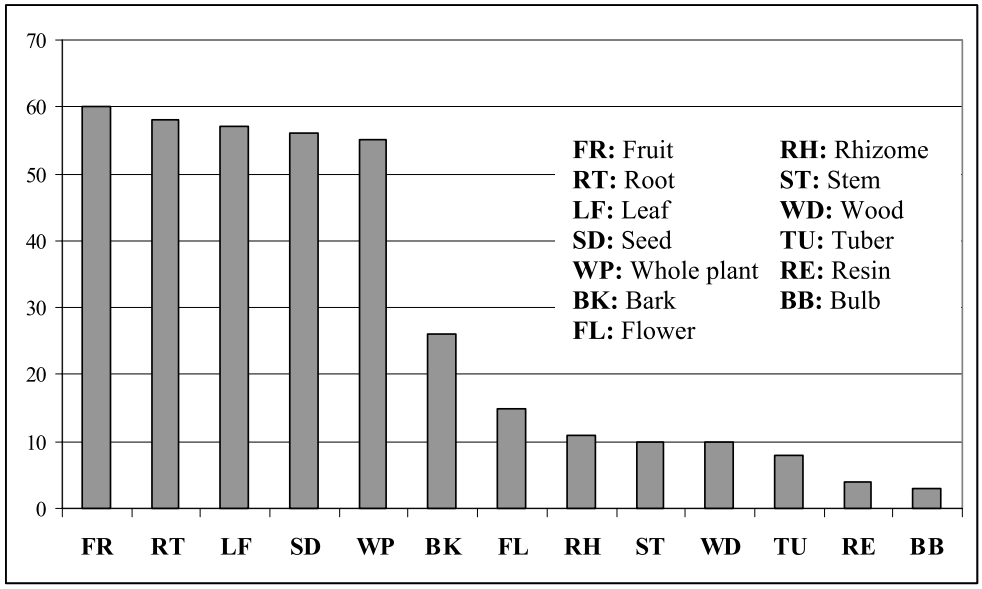


Fig. 2: Morphological parts of plant used in Ayurvedic, Unani, Siddha, Homoeopathic and Proprietary medicines

The need of genuine and quality raw material is always a concern of pharmaceutical industry due to resourcing of herbal drugs from commercial sources. To fetch the demand of commerce, drugs are collected from wild sources by the unskilled or semiskilled workers. Collection by unskilled or semiskilled workers, nonavailability or shortage of prescribes plant species and unscrupulous trade practices herbal drugs are prone to adulteration and substitution which ultimately impact the quality of medicines (Sharma & Dutt, 2010, Sharma *et al*., 2011). The manpower engaged in the trade of herbal drugs should have an exposure to the norms regulations and good collection and storage practices.

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
1	Aak	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Aankha	RT	+	+	+	+	+
2	Aak	*Calotropis procera* (Ait.) R. Br.	Asclepiadaceae	Aak	RT	+				
3	Aalu	*Solanum tubrosum* L.	Solanaceae	Aalu	ST	+			+	
4	Aaru	*Prunus persica* (L.) Betsch.	Rosaceae	Aru	FR	+			+	
5	Adrak	*Zingiber officinale* Rosc.	Zingiberaceae	Adrak	RH	+	+	+	+	+

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
6	Afsanteen	*Artemisia absinthium* L.	Asteraceae	----------	LF	+		+		
7	Agnibyo	*Premna latifolia* Roxb.	Verbenaceae	Aganyo	ST	+				
8	Ain, Sadga fale	*Terminalia alata* Heyne ex Roth.	Combretaceae	Asin	BK	+				
9	Ajain	*Alstonia scholaris* (L.) R. Br.	Apocynaceae	Ajan	LF, BK	+			+	
10	Ajmoda	*Apium graveolens* L.	Apiaceae	Shalari	SD	+		+	+	+
11	Ajwain	*Trachyspermum ammi* (L.) Sprague	Apiaceae	Ajwain	SD	+	+	+		+
12	Akasbel	*Cuscuta reflexa* Roxb.	Cuscutaceae	Agasilair	WP	+		+	+	
13	Akhroth	*Juglans regia* L.	Juglandaceae	Akhod	FR, BK	+		+	+	+
14	Alsi	*Linum usitatissimum* L.	Linaceae	Alsi	SD	+		+	+	+
15	Ama haldi	*Curcuma amada* Roxb.	Zingiberaceae	Biada	RH	+				
16	Amaltaash	*Cassia fistula* L.	Caesalpini-aceae	Kirala	FR	+	+	+	+	+
17	Amari	*Antidesma acidum* Retz.	Euphorbiaceae	Amli	LF					
18	Amba saal	*Mangifera indica* L.	Anacardi-aceae	Am	FR, BK	+	+	+	+	+
19	Ambika	*Tamarindus indica* L.	Caesalpini-aceae	Imli	FR	+	+	+		
20	Amesh	*Hippophae rhamnoides* L	Elaeagnaceae	Amesh	FR					
21	Amra	*Spondias pinnata* (L.f.) Kurz	Anacardiaceae	Amara	FR	+				
22	Amritdhara-ghas	*Tanacetum dolichophyllum* (Kitam.) Kitam.	Asteraceae	Guggal	WP					
23	Amrood	*Psidium guajava* L.	Myrtaceae	Amrood	FR	+				
24	Amrul	*Oxalis corniculata* L.	Oxalidaceae	Chalmora	WP	+	+			
25	Anaar	*Punica granatum* L.	Punicaceae	Darim	FR	+	+	+	+	+
26	Anantmul	*Hemidesmus indicus* (L.) R. Br.	Asclepiadaceae	Sariba	RT	+			+	+
27	Anjeer	*Ficus hispida* L. f.	Moraceae	Totmila	FR	+				

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
28	Ankol	*Alangium salvifolium* (L. f.) Wang.	Alangiaceae	Kuilu	RT	+				
29	Apamarga	*Achyranthes aspera* L.	Amaranthaceae	Chirchira	WP	+	+		+	+
30	Aparajit	*Clitoria ternatea* L.	Fabaceae	----------	RT	+				+
31	Aralu	*Oroxylum indicum* (L.) Venten	Bignoniaceae	Farkat	FR	+				
32	Arandi	*Ricinus communis* L.	Euphorbiaceae	Arandi	SD, LF	+	+	+	+	
33	Arhar	*Cajanus cajan* (L.) Millsp.	Fabaceae	Arhar	SD	+				
34	Arjun	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arnott.	Combretaceae	Khorasari	BK	+			+	+
35	Asetu	Colebrookea oppositifolia Sm.	Lamiaceae	Aseti	LF					
36	Ashoka	*Saraca asoca* (Roxb.) deWilde	Caesalpini-aceae	Ashok	BK	+			+	
37	Ashta	*Bauhinia recemosa* Lam.	Caesalpini-aceae	Jhinghora	BK	+		+		
38	Aswgandha	*Withania somnifera* (L.) Dunal.	Solanaceae	Asgandh	RT	+	+	+	+	+
39	Atibala	*Abutilon indicum* (L.) Sweet	Malvaceae	Kanghe	WP	+	+	+		
40	Atibala	*Sida rhombifolia* L.	Malvaceae	Bariara	WP	+				
41	Atibisha	Aconitum heterophyllum Wall. ex Royle	Ranunculaceae	Atis	RT	+	+	+		+
42	Ativisha	*Aconitum violaceum* Jacquem. ex Stapf.	Ranunculaceae	Dhudi-attes	RT					
43	Awala	*Phyllanthus emblica* L.	Euphorbiaceae	Awala	FR	+	+	+	+	+
44	Babool	*Acacia nilotica* (L.) Delile	Mimosaceae	Baboor	ST	+	+	+		+
45	Bach	*Acorus calamus* L.	Araceae	Boja	RH	+	+	+	+	+
46	Bahad	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	Arurh	FR	+	+	+	+	+
47	Bahrangi	*Clerodendrum serratum* (L.) Moon	Verbenaceae	Ban-bakri	LF	+	+	+		

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
48	Baigan	*Solanum melongena* L.	Solanaceae	Baigan	FR	+	+			
49	Bajrandi	*Potentilla fulgens* Wall. ex Hook. f.	Rosaceae	Akarada	RT	+				
50	Bakhara	*Premna barbata* Wall. ex Schauer	Verbenaceae	Bakhara	RT	+				
51	Bakul	*Mimusops elngi* L.	Sapotaceae	Maulsari	BK, LF	+				
52	Bala	*Sida acuta* Burm. f.	Malvaceae	Karenti	WP	+				
53	Balam kheera	*Kigelia africana* (Lam.) Benth.	Bignoniaceae	Balam-khira	FR					
54	Balu	*Sida cordifolia* L.	Malvaceae	Balu	WP	+				+
55	Ban kakadi	*Podophyllum hexandrum* Royle	Podophyllaceae	Ghee	FR	+				
56	Banafsa	*Viola pilosa* Blume.	Violaceae	Banfsa	WP	+				+
57	Banj	*Quercus leucotrichophora* A. Camus	Fagaceae	Banj	ST, BK	+		+		
58	Bans	Dendrocalamus strictus (Roxb.) Nees	Poaceae	Bans	ST	+		+		
59	Bantulasi	*Origanum vulgare* L.	Lamiaceae	Bantulsi	LF	+		+	+	
60	Bargad	*Ficus benghalensis* L.	Moraceae	Bar	WP	+	+	+	+	
61	Bel	*Aegle marmelos* (L.) Correa	Rutaceae	Bel	FR, LF	+	+	+	+	+
62	Ber	Ziziphus mauritiana Lam.	Rhamnaceae	Ber	FR	+		+		
63	Beshram	*Ipomoea carnea* Jacq.	Convolvulaceae	Behaya	BK					
64	Bhang	*Cannabis sativa* L.	Cannabaceae	Bhang	SD, RE	+	+	+	+	
65	Bhangeera	*Perilla frutescens* (L.) Britt.	Lamiaceae	Bhangira	SD				+	
66	Bhargi	*Clerodendrum indicum* (L.) Kuntze	Verbenaceae	Chigori	LF	+				
67	Bhilao	*Semecarpus anacardium* L. f.	Anacardiaceae	Bhilwa	SD, RT	+	+	+	+	
68	Bhindi	*Abelmoschus esculentus* (L.) Moench.	Malvaceae	Bhindi	FR	+				
69	Bhojpatra	*Betula utilis* D. Don	Betulaceae	Bhooj	BK	+				

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
70	Bhringraaj	*Eclipta prostrata* (L.) L.	Asteraceae	Bhangru	WP	+	+	+	+	+
71	Brahmi	*Bacopa monnieri* (L.) Wettst.	Scrophulari-aceae	Pan-bhrahmi	WP	+	+		+	+
72	Buransh	*Rhododendron arboreum* Sm.	Ericaceae	Burans	FL	+				+
73	Buyi awla	*Embelia ribes* Burm. f.	Myrsinaceae	Buyi awla	WP	+	+		+	
74	Chai	*Camellia sinensis* (L.) Kuntze	Theaceae	Chai	LF	+			+	
75	Chakotra	*Citrus grandis* (L.) Osbeck.	Rutaceae	Chakotra	FR					
76	Chaksu	*Cassia absus* L.	Caesalpini-aceae	Chaksu	SD			+		
77	Chameli	*Jasminum humile* L.	Oleaceae	Pili-chameli	FL, SD	+				
78	Champaka	*Michelia champaca* L.	Magnoliaceae	Champa	WP	+	+			
79	Chana	*Cicer arietinum* L.	Fabaceae	Chana	SD	+		+		
80	Chandani	*Nerium indicum* Mill.	Apocynaceae	Kaner	LF, RT	+	+	+		
81	Chandraian	Paeonia emodi Wall. ex Royle	Paeoniaceae	Chandraian	RT	+				
82	Chandra-soor	*Lepidium sativum* L.	Brassicaceae	Chandrasur	SD	+	+	+		
83	Charota	Cassia tora L.	Caesalpini-aceae	Banarh	SD	+	+			
84	Chir	*Pinus roxburghii* Sarg.	Pinaceae	Chir	WD, RE, FR	+				
85	Chir	*Pinus wallichiana* A.B. Jackson	Pinaceae	Kail	WD, RE, FR					
86	Chiraita	*Swertia angustifolia* Buch.-Ham. ex D. Don	Gentianaceae	Chiraitu	WP	+				
87	Chiraita	Swertia chirayita (Roxb. ex Fleming) Karsten	Gentianaceae	Chirayita	WP	+		+	+	+
88	Chitrak mool	Plumbago zeylanica L.	Plumbagin-aceae	Chitrak	RT	+	+	+		
89	Chop cheeni	*Smilax aspera* L.	Smilacaceae	Kukurdara	RT	+				
90	Chop cheeni	*Smilax zeylanica* L.	Smilacaceae	Bhitura	RT	+				
91	Chota tarbuj	*Citrullus colocynthis* (L.) Schrad. ex Eckl. & Zeyh.	Cucurbitaceae	Chota-tarbooj	FR	+	+	+	+	

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
92	Choti elaichi	Elettaria cardamomum (L.) Maton.	Zingiberaceae	Elaechi	FR	+	+	+		+
93	Chukandar	*Beta vulgaris* L.	Chenopodi-aceae	Chukander	RT	+			+	
94	Chura	*Aesandra butyracea* (Roxb.) Baehni	Sapotaceae	Chiura	SD					+
95	Chuyimuyi	*Mimosa pudica* L.	Mimosaceae	----------	WP	+				
96	Dachini	*Cinnamomum tamala* Nees ex Eberm.	Lauraceae	Kirkiria	LF, BK	+	+			
97	Daisaw paris	*Paris polyphylla* Sm.	Liliaceae	Satwa	RT	+				
98	Dandelion	Taraxacum officinale Weber	Asteraceae	Dudhli	RT	+			+	
99	Danti	*Baliospermum montanum* (Willd.) Muell.-Arg.	Euphorbiaceae	Jungali-jamalgota	SD, RT	+				
100	Daru haldi	*Berberis aristata* DC.	Berberidaceae	Kilmora	RT	+	+	+		+
101	Daru haldi	*Berberis asiatica* Roxb. ex DC.	Berberidaceae	Kilmora	RT	+				+
102	Datura	*Datura innoxia* Mill.	Solanaceae	Dhatura	SD	+	+			
103	Datura	*Datura stramonium* L.	Solanaceae	Dattura	SD	+		+	+	
104	Devdangar	*Cedrus deodara* (Roxb.) Loud.	Pinaceae	Devdar	WD	+	+	+		
105	Dhak ke phool	*Butea monosperma* (Lam.) Taub.	Fabaceae	Dhak	LF, FL	+	+	+		
106	Dhan	Oryza sativa L.	Poaceae	Dhan	SD	+	+	+		+
107	Dhaniya	*Coriandrum sativum* L.	Apiaceae	Dhanyiya	SD	+	+	+	+	
108	Dhyati	*Woodfordia floribunda* Salisb.	Lythraceae	Dhauli	FLs	+	+			
109	Dolu	*Rheum australe* D.Don	Polygonaceae	Archa	RT	+		+		
110	Drek	*Melia azedarach* L.	Meliaceae	Bakain	FR	+		+		
111	Dronpuspi	*Leucas plukenetii* (Roth.) Spreng	Lamiaceae	----------	WP	+			+	
112	Dukhnirvisi	*Cissampelos pareira* L.	Menisperm-aceae	Kali-bel	LF	+	+			+

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
113	Durva	*Cynodon dactylon* (L.) Pers.	Poaceae	Dub	WP	+	+		+	+
114	Eucalyptus	*Eucalyptus globulus* Labill.	Myrtaceae	Lyptus	LF	+			+	
115	Gajar	*Daucus carota* L.	Apiaceae	Gajar	RT	+		+		
116	Gambhari	*Gmelina arborea* Roxb.	Verbenaceae	Gumbhar	RT	+				
117	Gandhrajan	*Heracleum candicans* Wall. ex DC.	Apiaceae	------	SD					
118	Gandrain	*Angelica archangelica* L.	Apiaceae	Choru	RT	+				
119	Gandrain	*Angelica glauca* Edgew.	Apiaceae	Choru	RT	+				+
120	Ganna	*Saccharum officinarum* L.	Poaceae	Ganna	ST	+	+			
121	Gatti pipla	*Piper longum* L.	Piperaceae	Pipli	FR	+	+	+		+
122	Genhu	*Triticum aestivum* L.	Poaceae	Gehun	SD	+		+		
123	Gheekwar	*Aloe barbadensis* Mill.	Liliaceae	Patkwanr	LF	+	+	+		+
124	Giloy	*Tinospora cordifolia* (Willd.) Miers ex Hook. f. Thoms.	Menisperm-aceae	Gurg	ST	+	+	+	+	+
125	Ginnko	*Ginkgo biloba* L.	Ginkgoaceae	----------	LF				+	
126	Gokharu	*Tribulus terrestris* L.	Zygophyllaceae	Gokhru	WP	+	+	+	+	+
127	Gorakh-mundi	Sphaeranthus indicus L.	Asteraceae	----------	WP	+	+			
128	Gular	*Ficus racemosa* L.	Moraceae	Gulur	WP	+	+	+		
129	Gunj	*Abrus precatorius* L.	Fabaceae	Ratti	SD	+	+		+	+
130	Hajari	*Tagetes erecta* L.	Asteraceae	Hajari	FL	+				
131	Haldi	*Curcuma domestica* Vallars	Zingiberaceae	Haldi	RH	+	+	+	+	+
132	Hansraaj	*Adiantum capillus-veneris* L.	Adiantaceae	Kalichari	WP	+		+		
133	Harda	*Terminalia chebula* Retz.	Combretaceae	Hrar	FR	+	+	+	+	+
134	Harjod	*Cissus quadrangularis* L.	Vitaceae	Harjor	ST	+	+			

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
135	Heeng	*Ferula jaeschkeana* Vatke	Apiaceae	Jangali-heeng	RE	+				+
136	Hisalu	Rubus ellipticus Sm.	Rosaceae	Hisalu	FR, RT					
137	Ingar	*Barringtonia acutangula* (L.) Gaertn.	Barringtoni-aceae	Parsut	BK, RT, SD	+	+			
138	Iremeda	*Acacia farnesiana* (L.) Willd.	Mimosaceae	Vilyati-kikar	ST	+				
139	Isabgool	*Plantago major* L.	Plantagin-aceae	Lahuriya	LF	+		+	+	
140	Isharmul	*Aristolochia indica* L.	Aristolochi-aceae	----------	LF, RT	+				
141	Jal jamni	Cocculus hirsutus (L.) Diels	Menisperm-aceae	Jal-jamini	LF	+				
142	Jalgali kuth	*Arctium lappa* L.	Asteraceae	Kut	RT	+			+	+
143	Jambu	*Allium consanguineum* Kunth	Alliaceae	Jambu	LF	+				
144	Jambu	*Allium wallichii* Kunth.	Alliaceae	Jambu-dhun	LF	+				
145	Jamir	*Citrus hystrix* DC.	Rutaceae	Jamir	FR					+
146	Jamun	*Phoenix humilis* Royle ex Becc.	Arecaceae	Thakal	FR	+				
147	Jamun	*Syzygium cumini* (L.) Skeels	Myrtaceae	Jamun	FR	+	+	+		+
148	Jangali arandi	Jatropha curcas L.	Euphorbiaceae	Pahari-arand	SD	+			+	
149	Jarmala	*Phyllanthus amarus* Schumach. & Thonn.	Euphorbiaceae	Jarmala	WP	+	+			
150	Jaswanti	*Hibiscus rosa-sinensis* L.	Malvaceae	Gurhal	FL	+		+		+
151	Jatamansi	*Nardostachys grandiflora* DC.	Valerianaceae	Mansi	RT	+	+	+		+
152	Jau	*Hordeum vulgare* L.	Poaceae	Jau	SD	+		+		
153	Jhinghan	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Kalmina	LF BK	+	+			
154	Jivanti	*Trema orientalis* (L.) Blume	Ulmaceae	Jivan	LF, BK	+				
155	Kachnaar	*Bauhinia variegata* L.	Caesalpini-aceae	Kwairare	WP	+				

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
156	Kakadi	*Cucumis melo* L. var. *ultissimus* Duth. & Full.	Cucurbitaceae	Kakari	FR	+				
157	Kakarsingi	*Pistacia chinensis* Mill. ssp. *integerrima* (Stewart) Rech. f.	Anacardiaceae	Kakrsingi	WP	+	+			
158	Kakudsingi	*Garuga pinnata* Roxb.	Burseraceae	Titmar	BK					
159	Kala bansha	*Barleria prionitis* L.	Acanthaceae	Kala-bansa	WP	+	+			+
160	Kala hisalu	*Rubus niveus* Thunb.	Rosaceae	Kala-hisalu	FR, RT					
161	Kala jeera	*Carum carvi* L.	Apiaceae	Thoya	SD	+		+	+	+
162	Kala jeera	*Vernonia cinerea* (L.) Less.	Asteraceae	Kalgira, Kaljiri	SD	+				
163	Kala-datura	*Datura fastuosa* L.	Solanaceae	Kala-dahtura	SD	+	+		+	
164	Kalam	*Mitragyna parvifolia* (Roxb.) Korth.	Rubiaceae	Phaldu	BK, LF	+				
165	Kali musali	*Curculigo orchioides* Gaertn.	Hypoxidaceae	Talmuli	RH	+	+	+		+
166	Kali sinki	*Lygodium flexuosum* (L.) Sw.	Lygodiaceae	Kali-sinki	RH					
167	Kali tulasi	*Ocimum basilicum* L.	Lamiaceae	Marua	LF	+	+	+	+	+
168	Kaligewar	*Bupleurum falcatum* L.	Apiaceae	Janglee-jeera	SD					
169	Kalihari	*Gloriosa superba* L.	Liliaceae	Langhi	SD	+				
170	Kalmegh	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	Acanthaceae	Kalmegh	WP	+	+		+	+
171	Kamal phhol	*Nelumbo nucifera* Gaertn.	Nelumbon-aceae	Kamal	FL	+	+			
172	Kanchan	*Mucuna pruriens* (L.) DC.	Fabaceae	Kanchan	RT, SD	+	+			
173	Kandali phal	*Crinum asiaticum* L.	Amaryllidaceae	Kanwal	BB	+				
174	Kandaru	Coccinia grandis (L) Voigt.	Cucurbitaceae	Kanduri	WP	+	+		+	
175	Kanphuti	*Cardiospermum halicacabum* L.	Sapindaceae	Kanphuti	WP	+	+	+	+	

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
176	Kanthi buti	*Leucas lanata* Benth.	Lamiaceae	Pipswas	WP					
177	Kanthkari	*Solanum virginianum* L.	Solanaceae	Bhupendri	FR, RT	+	+	+		
178	Kaphal	*Duchesnea indica* (Andr.) Focke	Rosaceae	Kaphlya	LF					
179	Kapur kachari	*Hedychium acuminatum* (Rosc.) Wall.	Zingiberaceae	Kapor-kachri	RH					
180	Kapur kachari	*Hedychium spicatum* Buch.-Ham. ex Sm.	Zingiberaceae	Ban-haldi	RH	+				+
181	Karanja	*Pongamia pinnata* (L.) Pierre	Fabaceae	Karanjua	SD	+	+			
182	Karela	*Momordica charantia* L.	Cucurbitaceae	Karela	FR	+			+	+
183	Karo patta	*Murraya koenigii* (L.) Spreng.	Rutaceae	Gandela	Leef	+				
184	Karru	*Gentiana kurroo* Royle	Gentianaceae	Karru	RT	+		+		
185	Kasni	*Cichorium intybus* L.	Asteraceae	Kasni	SD	+			+	
186	Katphal	*Myrica esculenta* Buch.-Ham. ex D. Don	Myricaceae	Kaphal	BK, FR	+		+		+
187	Kela	*Musa paradisiaca* L. (*M. sapientum* L.)	Musaceae	Kela	FR	+	+	+	+	
188	Keol	Costus speciosus (Koen. ex Retz.) Sm.	Zingiberaceae	Keol	RT	+				+
189	Kesar	*Crocus sativus* L.	Iridaceae	Kesar	FL	+	+	+	+	
190	Khair	*Acacia catechu* (L.f.) Willd.	Mimosaceae	Khair	ST	+	+			
191	Khas	*Vetiveria zizanioides* (L.) Nash.	Poaceae	Khas, Veeran-mool	LF	+	+	+		
192	Kheera	*Cucumis sativus* L.	Cucurbitaceae	Ailaru	FR	+	+	+		
193	Khirni	*Manilkara hexandra* (Roxb.) Dubard	Sapotaceae	Khirni	BK, FL	+				
194	Khokali	*Acalypha indica* L.	Euphorbiaceae	Kuppi	WP		+		+	+
195	Khumani	*Prunus armeniaca* L.	Rosaceae	Chullu	FR	+				

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
196	Kirmani ova	Artemisia maritima L.	Asteraceae	Safed-purca	LF	+		+	+	
197	Kirmari	*Chenopodium ambrosioides* L.	Chenopodi-aceae	Kirmari	WP					
198	Krishnjraka	*Nigella sativa* L.	Ranunculaceae	----------	SD	+	+	+		
199	Kuchla	*Strychnos nux-vomica* L.	Loganiaceae	Kuchla	SD	+		+	+	+
200	Kulthi	*Macrotyloma uniflorum* (Lam.) Verdc.	Fabaceae	Gahat	SD	+				
201	Kumbra	*Benincasa hispida* (Thunb.) Cogn.	Cucurbitaceae	Bhujailu	FR	+	+	+		
202	Kunja	*Rosa brunonii* Lindl.	Rosaceae	Kunj	FL	+				+
203	Kurchi	*Holarrhena antidysenterica* Wall. ex A. DC.	Apocynaceae	Kuri-kurchi	BK	+		+	+	+
204	Kushnya	*Caltha palustris* L.	Ranunculaceae	Kushnya	RT				+	
205	Kutaki	*Picrorhiza kurrooa* Royle ex Benth.	Scrophulari-aceae	Kutki	RT	+	+	+		
206	Kuth	*Saussurea costus* (Falc.) Lipschitz	Asteraceae	Kut	RT	+	+			
207	Lahsun	*Allium sativum* L.	Alliaceae	Lahsun	BB	+	+	+	+	+
208	Langthang	*Hyoscyamus niger* L.	Solanaceae	Langthang	WP	+	+	+	+	
209	Lata karanj	*Caesalpinia bonduc* (L.) Roxb.	Caesalpini-aceae	Kanja	SD	+	+	+	+	+
210	Lodha	Symplocos racemosa Roxb.	Symplocaceae	Lodhra	BK	+		+		
211	Maduwa	*Eleusine coracana* (L.) Gaertn.	Poaceae	Mandua	SD	+				
212	Mahamenda	*Polygonatum cirrhifolium* (Wall.) Royle	Liliaceae	Salam-misri	RT	+				
213	Mahamenda	Polygonatum vetricillatum (L.) All.	Liliaceae	Deoringal	RT	+				
214	Mahanimba	*Ailanthus excelsa* Roxb.	Simaroubaceae	Arua	LF, BK	+				
215	Mahawa	*Madhuca longifolia* (J.Koenig) MacBride	Sapotaceae	Mahawa	WP	+	+			

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
216	Maljangni	Celastrus paniculatus Willd.	Celastraceae	Kaunya	BK, SD	+	+	+		
217	Malu	*Bauhinia vahlii* Wight & Arnott.	Caesalpini-aceae	Malu	LF	+				
218	Mamiri	Thalictrum foliolosum DC.	Ranunculaceae	Mamiri	RT	+		+		
219	Manduk parni	*Centella asiatica* (L.) Urban	Apiaceae	Bhrahmi	WP	+	+		+	+
220	Manjeetha	*Rubia manjith* Roxb. ex Fleming	Rubiaceae	Manjeeth	RT	+	+	+		
221	Marod fail	*Helicteres isora* L.	Sterculiaceae	Marorphali	FR	+	+	+		
222	Masoor	*Lens culinaris* Medik.	Fabaceae	Masoor	SD	+		+		
223	Matar	*Pisum sativum* L.	Fabaceae	Kalaon	FR	+		+		
224	Mehandi	*Lawsonia inermis* L.	Lythraceae	Mehadi	LF	+	+	+		+
225	Methi	*Trigonella foenum-graecum* L.	Fabaceae	Methi	SD	+	+	+		+
226	Mircha	*Capsicum annuum* L.	Solanaceae	Mircha	FR	+			+	
227	Mokoy	*Solanum nigrum* L.	Solanaceae	Makoi	WP	+	+	+	+	+
228	Morning glory	*Ipomoea nil* (L.) Roth	Convolvulaceae	Mothya	SD	+				
229	Morphankhi	*Thuja orientalis* L.	Cupressaceae	Morpankhi	LF					
230	Muli	*Raphanus sativus* L.	Brassicaceae	Muli	RT	+	+		+	
231	Munakha	*Vitis vinifera* L.	Vitaceae	Angoor	FR	+	+	+		+
232	Nagar motha	*Cyperus rotundus* L.	Cyperaceae	Moth	RT	+	+	+		
233	Neelkanthi	*Ajuga bracteosa* Wall. ex Benth.	Lamiaceae	Ratpatia	WP					+
234	Neemba	*Azadirachta indica* A. Juss.	Meliaceae	Neem	BK, LF	+	+	+	+	+
235	Nimbu	*Citrus aurantium* L.	Rutaceae	Nimbu	FR	+				
236	Nimbu	*Citrus medica* L.	Rutaceae	Nimbu	FR	+		+		
237	Nirgundi	*Vitex negundo* L.	Verbenaceae	Shinwali	WP	+	+	+		+
238	Ogal	*Fagopyrum esculentum* (L.) Moench.	Polygonaceae	Palthi	SD				+	

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
239	Paanfaali	*Citrus limon* (L.) Burm.f.	Rutaceae	Neebu	FR	+				
240	Painya	*Prunus cerasoides* D.Don	Rosaceae	Paya	FR	+				
241	Palaash	*Juniperus communis* L.	Cupressaceae	Pallas	LF	+		+	+	
242	Pangar	*Castanea sativa* Mill.	Fagaceae	Pangar	FR				+	
243	Paniala	*Flacourtia jangomas* (Lour.) Raeusch.	Flacourtiaceae	Jamuna	BK, FL	+				
244	Papeeta	*Carica papaya* L.	Caricaceae	Papita	FR	+		+	+	
245	Parijaat	*Nyctanthes arbor-tristis* L.	Oleaceae	Harsingar	LF	+			+	
246	Parslane	*Portulaca oleracea* L.	Portulacaceae	Kulfa	WP	+				
247	Parval	*Trichosanthes dioica* Roxb.	Cucurbitaceae	Palwal	FR	+				
248	Pashanbhed	*Bergenia ciliata* (Royle) Raizada	Saxifragaceae	Pathar-chat	RH	+				+
249	Pashanbhed	*Bergenia ligulata* (Wall.) Engler	Saxifragaceae	Silphoda	RH	+				
250	Pattar choor	*Coleus barbatus* (Andr.) Benth.	Lamiaceae	Jautil	RT					+
251	Phuliya	Hypericum perforatum L.	Hypericaceae	Choli-phulya	WP				+	
252	Pitapapada	*Fumaria indica* (Haussk.) Pugsley	Fumariaceae	Pithpapra	WP	+		+	+	
253	Piyali	*Buchanania lanzan* Spreng.	Anacardiaceae	Piyal	SD	+	+			+
254	Podina	*Mentha piperita* L.	Lamiaceae	Podina	LF				+	
255	Poi	*Basella alba* L.	Basellaceae	Poy	LF	+				
256	Popular	*Populus ciliata* Wall.	Salicaceae	Shyan	WD					
257	Posta	*Papaver somniferum* L.	Papaveraceae	Afim	SD	+	+	+		
258	Potato tree	*Solanum erianthum* D.Don	Solanaceae	Akra	FR	+				
259	Priyangu	*Callicarpa macrophylla* Vahl	Verbenaceae	Daiyya	SD	+				
260	Pudina	*Mentha arvensis* L.	Lamiaceae	Paudina	LF	+	+	+	+	+
261	Punernava	*Boerhavia diffusa* L.	Nyctaginaceae	Punryaru	WP	+	+		+	+

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
262	Pyaj	Allium cepa L.	Alliaceae	Pyaj	BB	+	+	+	+	+
263	Rai	*Brassica juncea* (L.) Czern. & Coss	Brassicaceae	Rai	SD	+				
264	Raitung	*Rhus parviflora* Roxb.	Anacardiaceae	Tang	LF	+		+		
265	Ram bansh	*Agave americana* L.	Agavaceae	Ram-bansh	LF	+			+	
266	Ram dana	*Amaranthus caudatus* L.	Amaranthaceae	Kidari-chua	SD					
267	Ram dana	*Amaranthus tricolor* L.	Amaranthaceae	Chaulai	SD, LF	+				
268	Ram-tulsi	*Ocimum gratissimum* L.	Lamiaceae	Ram-tulasi	LF	+			+	
269	Rasna	*Pluchea lanceolata* (DC.) C.B. Clarke	Asteraceae	----------	WP	+				
270	Rat rani	*Cestrum nocturnum* L.	Solanaceae	Rat-ki-rani	FL					
271	Rattan joth	*Arnebia benthamii* (Wall. ex G. Don) I.M. Johnston	Boraginaceae	Laljari	RT	+				+
272	Reetha	*Sapindus mukorossi* Gaertn.	Sapindaceae	Ritha	FR	+				+
273	Ridhi, Varidhi	*Habenaria intermedia* D.Don	Orchidaceae	Ridhi-bidhi	WP	+				
274	Rohini	*Mallotus philippensis* (Lam.) Muell.-Arg.	Euphorbiaceae	Rohini	FR	+		+	+	
275	Rojmari	*Achillea millefolium* L.	Asteraceae	Gangrain	WP					
276	Rookhi	Megacarpaea polyandra Benth.	Brassicaceae	Barmoola	LF, RT					+
277	Rosha	*Cymbopogon martinii* (Roxb.) W. Watson	Poaceae	Piriya-ghas	LF	+				
278	Saal	*Shorea robusta* Roxb. ex Gaertn.f.	Dipterocarp-aceae	Kororal	WD	+	+			
279	Saal parni	*Desmodium gangeticum* (L.) DC.	Fabaceae	Salpalnu	LF	+	+		+	+
280	Sadabahaar	*Catharanthus roseus* (L.) G. Don	Apocynaceae	Sada-bahar	LF	+			+	

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
281	Safed moosli	*Chlorophytum tubrosum* Baker	Liliaceae	Safed-moosali	TU	+				+
282	Sahtut	*Morus alba* L.	Moraceae	Tooth	FR	+				
283	Salam panja	*Dactylorhiza hatagirea* (D.Don) Soo.	Orchidaceae	Hattazari	TU	+				+
284	Salammishri	*Litsea monopetala* (Roxb.) Pers.	Lauraceae	Katmara	BK	+				
285	Sankhpuspi	*Evolvulus alsinoides* L.	Convolvulaceae	Sankha-pushpi	WP	+		+		+
286	Sareefa	*Annona squamosa* L.	Annonaceae	Sitaphal	FR	+				
287	Sarpgandha	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Apocynaceae	Sarpagandha	RT	+			+	+
288	Sarson	*Brassica campestris* L.	Brassicaceae	Sarson	SD	+		+		
289	Satavari	*Asclepias curassavica* L.	Asclepiadaceae	Lalma	RT	+			+	+
290	Satavari	*Asparagus curillus* Buch.-Ham. ex Roxb.	Liliaceae	Jhiran	TU	+				
291	Satavari	*Asparagus filicinus* Buch.-Ham. ex D. Don	Liliaceae	Jhirni	TU	+				
292	Satavari	*Asparagus racemosus* Willd.	Liliaceae	Kairuwa	TU	+	+	+	+	+
293	Sathjalani	*Ainsliaea aptera* DC.	Asteraceae	Karu-buti	RT					
294	Satyanasi	*Argemone mexicana* L.	Papaveraceae	Satyanasi	WP	+			+	
295	Saunf	Foeniculum vulgare Mill.	Apiaceae	Sanuf	SD	+	+	+	+	+
296	Seb	*Pyrus malus* L.	Rosaceae	Seb	FR					
297	Semal	*Bombax ceiba* L.	Bombacaceae	Semar	FL	+	+			
298	Shisham	*Dalbergia sissoo* Roxb.	Fabaceae	Shisham	WD	+		+		
299	Shishav	*Dalbergia latifolia* Roxb.	Fabaceae	Shisham	WD	+				
300	Siras	*Albizia lebbeck* (L.) Benth.	Mimosaceae	Siras	WP	+	+			+
301	Sitafal	*Cucurbita maxima* Duch. ex Lam.	Cucurbitaceae	Kaddu	FR	+		+	+	

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
302	Soya	*Glycine max* (L.) Merr.	Fabaceae	Soyabeen	SD					
303	Suraj mukhi	*Helianthus annuus* L.	Asteraceae	Surajmukhi	SD	+			+	
304	Tadiras	*Tectona grandis* L.f.	Verbenaceae	Saigaun	WD	+				
305	Tagar	*Valeriana hardwickii* Wall. ex Roxb.	Valerianaceae	Nahani	RT	+				+
306	Tagar	*Valeriana jatamansi* Jones	Valerianaceae	Samewa	RT	+		+		
307	Talimkhana	*Hygrophila auriculata* (Schumach.) Heine	Acanthaceae	Talimkhana	WP	+				
308	Talishpatra	*Abies spectabilis* (D. Don) Mirle.	Pinaceae	Ragu	LF	+				
309	Tamatar	*Lycopersicon lycopersicum* (L.) Karsten	Solanaceae	Tamatar	FR				+	
310	Tanbaku	*Nicotiana tabacum* L.	Solanaceae	Tamakhu	LF	+		+	+	
311	Tarun	*Dioscorea belophylla* Voigh.	Dioscoreaceae	Tairu	TU	+				
312	Tarun	*Dioscorea deltoidea* Wall. ex Griseb.	Dioscoreaceae	Tairu	TU					
313	Tez patta	*Cinnamomum zeylanicum* Nees	Lauraceae	Tez paat	LF	+		+	+	+
314	Thavanam	Artemisia nilagirica (C.B. Clarke) Pamp.	Asteraceae	Kunjo	WP	+		+	+	
315	Thuner	*Taxus baccata* L. subsp. *wallichiana* (Zucc.) Pilger	Taxaceae	Thuner	LF	+	+		+	
316	Thungplam	*Trewia nudiflora* L.	Euphorbiaceae	Tumari	RT	+				
317	Til	Sesamum orientale L.	Pedaliaceae	Til	SD	+	+	+		+
318	Tilpuspi	*Digitalis purpurea* L.	Scrophularia-ceae	----------	LF				+	+
319	Timaru	*Zanthoxylum armatum* DC.	Rutaceae	Timbru	SD	+		+		+

Sl. No.	Trade Name	Name of Plant	Family	Vernacular Name	Part Used	System of medicine				
						A	S	U	H	PM
320	Tit-baigun	*Solanum torvum* Swartz	Solanaceae	----------	WP	+				
321	Toon	*Toona ciliata* Roem.	Meliaceae	Tun	WD					
322	Tulasi	*Ocimum canum* Sims.	Lamiaceae	Tulsi	LF	+			+	
323	Tulsi	*Ocimum tenuiflorum* L.	Lamiaceae	Tulasi	LF	+	+	+	+	+
324	Turayi	*Luffa acutangula* (L.) Roxb.	Cucurbitaceae	Turayi	FR	+	+		+	
325	Turayi	*Luffa aegyptiaca* Mill.	Cucurbitaceae	Toral	FR	+				
326	Tut jadi	*Ephedra gerardiana* Wall. ex Stapf.	Ephedraceae	Tut-gamtha	WP	+			+	
327	Uteesh	*Alnus nepalensis* D.Don	Betulaceae	Utees	WD	+				
328	Van ajvain	Thymus linearis Benth.	Lamiaceae	Van-ajwain	WP			+		
329	Van haldi	*Curcuma aromatica* Salisb.	Zingiberaceae	Vanhaldi	RH	+				
330	Van kakadi	*Cucumis hardwickii* Royle	Cucurbitaceae	Elaroo	FR					
331	Varahikand	*Dioscorea bulbifera* L.	Dioscoreaceae	Gethi	TU	+				
332	Vasaka	*Justicia adhatoda* L.	Acanthaceae	Bansu	LF	+		+	+	+
333	Vatsnabha	*Aconitum balfouri* Stapf.	Ranunculaceae	Mithu	RT	+				+
334	Vidarikand	*Pueraria TUosa* (Roxb. ex Willd.) DC.	Fabaceae	Siralu	RT	+				
335	Vish	*Aconitum ferox* Wall. ex Ser.	Ranunculaceae	Meetha-bish	RT	+	+		+	+
336	Zeera	Cuminum cyminum L.	Apiaceae	Zeera	SD	+	+			+
337	Zufah yabis	*Hyssopus officinalis* L.	Lamiaceae	----------	WP	+		+		

Abbreviations: A: Ayurveda; BB: Bulb; BK: Bark; FL: Flower; FR: Fruit; H: Homoeopathy; LF: Leaf; PM: Proprietary medicines; RH: Rhizome; RE: Resin; RT: Root; S: Siddha; SD: Seed; ST: Stem; TU: Tuber; WD: Wood; WP: Whole plant; U: Unani.

Plate - 1

Dried roots of *Asparagus racemosus* Willd.

Dried bark of *Betula utilis* D. Don

Dried roots of *Chlorophytum tuberosum* Baker

Dried tuber of *Dactylorhiza hatagirea* (D.Don) Soo.

Dried root of *Rheum australe* D.Don

Dried leaf of *Nicotiana tabacum* L.

Dried leaf of *Nardostachys grandiflora* DC.

Plate - 2

Locally storage of dried medicinal plants

A Proprietary medical practitioner in Almora district, Uttarakhand

A view of proprietary medicines shop

Lady harvesting the seeds of *Aconitum heterophyllum* Wall. ex Royle

A view of rode side pharmacy

Plate - 3

Cutting the collected roots of *Rheum australe* D.Don for drying

Wild growth of *Aconitum balfouri* Stapf. in natural habitat

***Ajuga bracteosa* Wall. ex Benth.**

***Bombax ceiba* L.**

***Catharanthus roseus* (L.) G. Don**

***Rosa brunonii* Lindl.**

Plate - 4

***Chlorophytum tuberosum* Baker**

***Morus alba* L.**

***Plumbago zeylanica* L.**

***Arnebia benthamii* (Wall. ex G. Don) I.M. Johnston**

References

Anonymous, 1971-2006. Homoeopathic Pharmacopoeia of India (Vol. 1-9th). Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 1978. The Ayurvedic Formulary of India, Part-I, (English ed.) Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 1981. National Formulary of Unani Medicine, Part-I, (English ed.), Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 1984. Siddha Formulary of India, Part-I, (Tamil ed.), Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 1992. Siddha Formulary of India, Part-I, (English ed.), Govt. of India, Ministry of Health & Family Welfare, New Delhi

Anonymous, 1999. National Formulary of Unani Medicine, Part-II, (English ed.), Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 2000. The Ayurvedic Formulary of India, Part-II, (English ed.) Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 2001. National Formulary of Unani Medicine, Part-III, (English ed.), Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 2006. National Formulary of Unani Medicine, Part-IV (English ed.), Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 2008. National Formulary of Unani Medicine, Part-V (English ed.), Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Anonymous, 2009. Ayurvedline.: Ayurvedic Drug Index. Bangalore.

Anonymous, 2011.The Siddha Formulary of India, Part-II, (Tamil ed.) Govt. of India, Ministry of Health & Family Welfare, New Delhi.

Agnihotri, A. K., Tiwari, Lalit, Rai, Nitin, Sharma, Rajeev Kr. and Sikarwar, R. L. S., 2012. Traditional healthcare uses of wild plant prevalent in Haldwani Forest area, Central Himalaya. Research & Reviews: Journal of Pharmaceutical Science and Technology. (In press)

Agrawal, D. P. and J. S. Kharakwal, 1998. Central Himalayas: An Archaeological, Linguistic and Culural Synthesis. Aryan Books International, New Delhi.

Badoni, A. K., 1989-1990. Remark on the High Altitudinal Medicinal Plants of Garhwal Himalaya. *Himalayan Studies and Regional Development* 13&14: 37-45.

Rai, Nitin, Rajeev Kr. Sharma, Sunil Dutt and V. K. Singh. 2011. Market survey of commercially exploited Unani herbal drugs: available, reserouces and quality assurance. *Hippocreatic Journal of Unani Medicine* 6(4): 97-123.

Pande, P. C., Lalit Tiwari and H. C. Pande. 2006. *Folk-Medicine and Aromatic*

Plants of Uttaranchal. Bishen Singh and Mahendra Pal Singh, Dehra Dun.

Singh, D. K. and P. K. Hajra. 1997. Floristic diversity. In *Biodiversity Status in the Himalaya*. (Ed. Gujral). British Council, New Delhi, pp. 23-38.

Samant, S. S., U. Dhar and L. M. S. Palni, 1998. *Medicinal Plants of Indian Himalaya: Diversity, Distribution, Potential Values.* Gyanodaya Prakashan, Nainital.

Tiwari, Lalit and P. C. Pande. 2005. Himalayan Medicinal Plants in Ayurvedic Text: with references to Sushrut Samhita. *Journal of History of Science and Medicine* **20**(1-2): 45-60.

Sharma, Rajeev Kr. and Dutt Sunil, 2010. Herbal drug standardization and appraisal of modern scientific methods. *In:* Ayurveda in Transition (Eds. T. S. Muraliodharan and M. R. Ragav Variier), pp. 185-264

Sharma, Rajeev Kr., Dutt, Sunil and Rai, Nitin, 2011. Quality issue in respect of adulteration in herbal ingredients used in Ayurvedic formulation. *Ind. J. Pharm. Herb. Res*. 1(1): 18-25.

Studies on Physico-chemical Standardization and Antibacterial Activity of 'Jawarish-e-Zanjabeel' – A Unani Polyherbal Formulation

***Rampratap Meena,**
P. Meera Devi Sri,
D. Ramasamy, S. Mageswari,

M. Abdul Kareem and
[1]Shamshad Ahmed Khan

Regional Research Institute of Unani Medicine, 1 West Madha Church Street, Royapuram, Chennai – 600 013

1. Central Council for Research in Unani Medicine, 61-65, Institutional Area, Janakpuri, New Delhi – 58.

Abstract

The compound drug Jawarish-e-Zanjabeel is a poly herbal Unani drug. It is being used in the various ailments like diarrhea, anorexia and flatulence in the stomach. The present study was designed to evaluate the pharmacopoeial standards, WHO parameters, antibacterial activity and MIC of the drug. The quality control parameters like microbial content, heavy metals, aflatoxin and pesticidial residues were found within permissible limits. The antimicrobial study revealed that the drug has potent activity against the uropathogenic organisms responsible for urinary infections like uretritis, cystitis, pyelonepritis, acute prostatitis and urosepsis. On comparison the drug exhibited higher degree of activity against all the the *E.coli* strains whereas moderate to low activity against the other tested organisms at 50 mg/ml concentration.

Key words: Physico-chemical parameters, TLC, Heavy metals, Microbial load, Aflatoxins, Pesticide residues, Antibacterial activity.

1. Introduction

In modern era, herbal medicines are seen as potential medicines for a variety of diseases. There has been a striking increase in use of traditional system of medicine in both developing and developed countries due to their natural origin and no side effects (Pulok Mukherjee, 2008). But challenges are many before realizing the dream of safe and potent drug for effective treatment of patients and improvement of quality of life. There remains a challenge for developing a scientific basis of herbal medicines. Therefore, standardization and clinical activities are highly warned. However, the advent of quality standardization and biological activities of these drugs will certainly open new frontiers for treatment of many diseases (Sharma and Arora, 2006). The drug Jawarish-e-Zanjabeel is one of the poly herbal Unani formulation categorized under Majooniath listed in the National Formulary of Unani Medicine, Part - I. The drug was prepared in three batches at laboratory scale using authenticated raw drugs as per Standard Operating Procedure (SOP). The drug is being used in the ailments of diarrhea, anorexia and flatulence in the stomach (Anonymous, 2006).

The urinary tract infection is the most common infection affecting the urinary systems- kidney, ureteres, blader and urethra. Normally urine is sterile and is free of microbes. Infections occurs when micro organisms especially bacteria like *E.coli*, *Klebsiella* species, *Staphylococcus* species enters in the urinary systems.

*Author for correspondence

Hence, the present study was subjected to evaluate physico-chemical parameters, thin layer chromatography, heavy metal, microbial contamination, aflatoxin level, pesticide residue and antibacterial activity to assess the potent activity of the drug against the UTI pathogens isolated from the UTI patients.

2. Material and Methods

2.1. Collection of Raw drugs

In order to develop a scientific method for the preparation of this formulation, the raw drugs were procured from local raw drug dealers Chennai. All the raw drugs were identified by botanist using pharmacognostical methods (Kokate, 2000). Jawarish-e-Zanjabeel drug was prepared as per the formulation composition given in NFUM part–I (Anonymous, 2006). The formulation contains eight single drugs namely Zanjabeel (*Zingiber officinale* Rosc. – Rhizome), Samagh-e-Arabi (*Acacia latifolia* (L) Willd.ex.Del – Gum), Dana Heel Khurd (*Elettaria cardamomum* (L) Maton. – Seed), Belgiri (*Aegle marmelos* Corr. - Fruit pulp), Saleekha (*Cinnamomum cassia* Blume. - Stem bark), Zarambad (*Curcuma zedoaria* Rosc. – Rhizome), Nishashta-e-Gandum (*Triticum aestivum* Linn. - Starch powder) and Sugar.

2.2. Collection of microorganism

Urine samples of 25 UTI infected patients were collected from various hospitals and clinical laboratories in Chennai. All the samples were subjected to conventional microbiological analysis using Macconkey agar and Blood agar (Mackie & McCartney, 1996). The pure cultures of three strains of *E.coli* coded as JZECO-1, JZECO-2, JZECO-3 , three strains of *Klebsiella pneumoniae* coded as JZKP-1, JZKP-2, JZKP-3 and three strains of *Staphylococcus saprophyticus* coded as JZSS-1, JZSS-2, JZSS-3 were maintained in nutrient agar slants and were used for further studies. All the cultures were confirmed at the molecular level in the Department of Microbiology and compared with the NCBI database.

2.3. Physico-chemical analysis

The prepared three batch samples were subjected for Physico-chemical studies like total ash, acid insoluble ash, water soluble ash, solubility in alcohol and water, loss on drying at 105º. The bulk density, sugar estimation and *pH* values for 1% and 10% aqueous solution were also carried out (Anonymous, 1987).

2.4. Thin layer chromatography

The chloroform and alcohol extracts of the drug were applied on precoated silica gel 60 F_{254} TLC plate (E.merck) as absorbent and developed the plate using solvent systems, toluene : ethyl acetate 9:1 and 1: 1 respectively. After developing, the plates were dried and observed the colour spots at UV-254, UV-366 nm and vanillin-sulphuric acid spraying reagent (Wagner *et. al*., 1984).

2.5. WHO parameters

The microbial load and heavy metal were carried out as per the WHO guidelines (Anonymous, 1998). Aflatoxin and pesticide residues were carried out by standard methods (Anonymous, 2000).

2.6. Antibacterial activity

The in-vitro antibacterial activity of the drug Jawarish-e-Zanjabeel was performed using the Cup plate method (Anonymous, 1996). The required amount of Muller hinton agar plates were prepared and swabbed with three clinical isolates of *E.coli* coded as *JZECO*-1*, JZECO*-2*, JZECO*-3*,* three clinical isolates of *Klebseilla* spp coded as *JZKP-1, JZKP-2, JZKP-3* and three clinical isolates of *Staphylococcus* spp coded as *JZSS-1, JZSS-2, JZSS-3* along with the standard reference culture *E.coli* ATCC 25922 after confirmation using NCBI database. The plates were allowed to stand for few minutes. Approximately 6mm diameter wells were made using the agar gel borer and 100µl of 50mg/ml conc of the drug dissolved in the solvent DMSO was added into the well (Howard C Ansel et al.,1969) . The commercially available drug ampicillin (10mcg/disc) was used as positive control. The plain disc with100µl loaded solvent DMSO was also placed as the vehicle control. The plates were incubated at 37°C for 24 hours.

2.7. Determination of Minimum inhibitory concentration (MIC)

The MIC is the lowest concentration of the drug required to inhibit the microorganism was also determined by the agar diffusion method and by cup plate method (Anonymous 1982). A series of petridishes containing 20ml of Muller hinton agar media incorporated with increasing concentration of the drug 25mg/ml, 12.5mg/ml, 6.25mg/ml and 3.125mg/ml were prepared and allowed to solidify. The bacterial isolates were spot inoculated into each plate. The lowest concentration of the drug that completely inhibits the growth was determined after overnight incubation at 37°C

3. Results and Discussion

Jawarish-e-Zanjabeel is brown, semi solid with agreeable odour and sweetish bitter in taste. The drug was spreaded in a petridish and observed, it did not show any filth, fungus or objectionable extraneous matter.

3.1. Physico-chemical analysis

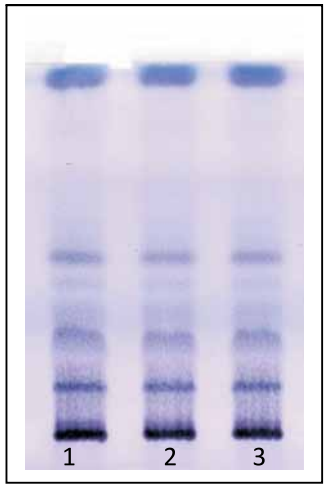
Moisture content of this drug shows 22.08%. The alcohol soluble extractive (38.20%) might be due to the extraction of polar chemicals constituents and the water soluble extractives 58.36% indicate the presence of inorganic constituents. The Physico-chemical data of the drug are shown in Table - I.

Table-1. Analysis of physico-chemical parameters

S. No.	Parameters Analyzed	Batch -I	Batch -II	Batch -III
1	Extractives Alcohol soluble matter (%) Water soluble matter (%)	 38.68 58.72	 37.80 57.84	 38.12 58.52
2	Ash Total ash (%) Acid insoluble ash (%)	 0.82 0.22	 0.91 0.31	 0.79 0.20
3	pH values 1% Aqueous solution 10% Aqueous solution	 5.80 4.61	 5.81 4.74	 5.71 4.63
4	Sugar estimation Reducing sugar (%) Non-reducing sugar (%)	 39.39 9.85	 39.56 9.52	 39.75 10.09
5	Moisture (%)	22.06	22.29	21.89
6	Bulk Density	1.3806	1.4009	1.4208

3.2. Thin Layer Chromatography analysis

Thin layer chromatography studies of chloroform and alcohol extract of all the three batch samples showed identical spots under UV-254,366nm and vanillin-sulphuric acid reagent. The R_f values of the chloroform and alcohol extracts were shown in Table - II and III. The plates were derivatised using vanillin-sulphuric acid reagent and heated at 105º till the color spots appeared (Fig. 1 & 2).



Track 1. Batch - I
Track 2. Batch - II
Track 3. Batch - III

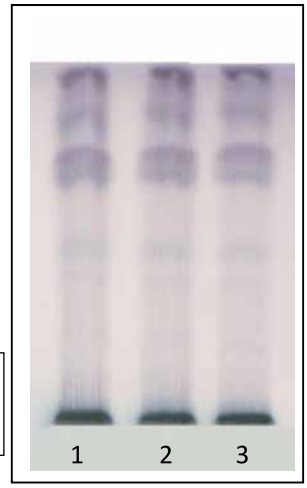


Fig. 1. Chloroform Extract
Solvent system: Toluene: Ethyl acetate (9 : 1)
Detector: V. S. Reagent

Fig. 2. Alcohol Extract
Solvent system: Toluene: Ethyl acetate (1 : 1)
Detector: V. S. Reagent

Table-2: R_f Values of chloroform extract

Solvent system	Rf Values		
Toluene: Ethyl acetate (9 : 1)	UV 254nm	UV 366nm	V. S. Reagent
	0.84 Light pink	0.84 Blue	0.95 Violet
	0.47 Pink	0.54 Light blue	0.81 Light grey
	0.20 Light pink	0.20 Blue	0.47 Grey
	0.15 Pink	0.11 Light blue	0.40 Light grey
	0.11 Light pink		0.31 Light grey
			0.25 Violet
			0.12 Violet

Table-3: R_f Values of alcohol extract

Solvent system	Rf Values		
Toluene: Ethyl acetate (1 : 1)	UV 254nm	UV 366nm	V. S. Reagent
	0.86 Light pink	0.79 Blue	0.95 Violet
	0.79 Pink	0.75 Pale blue	0.84 Pink
	0.68 Light pink	0.20 Violet	0.75 Violet
	0.56 Light pink	0.15 Blue	0.68 Violet
	0.45 Pink		0.47 Grey
	0.30 Light pink		0.37 Light grey
	0.13 Light pink		0.20 Grey

3.3. Heavy metals, microbial load, aflatoxins, pesticide residues

The study carried out on heavy metals such as lead and mercury were present within the permissible limit and other elements cadmium and arsenic were found below the detection limit (Table - IV). The microbial load was found within the permissible limit (Table - V). The studies of other parameters like aflotoxins such as B_1, B_2, G_1 and G_2 were not found in the drug (Table –VI). The pesticide residue such as organo chlorine group, organo phosphorus group, alachlor, aldrin, chlordane, DDT, endosulfan, heptachlor, lindane and malathion were also not detected in the drug samples (Table – VII).

Table-4: Estimation of heavy metal

S. No.	Name of the metal	Results	WHO & FDA Limits
1	Arsenic	Below detection limit	10 ppm
2	Cadmium	Below detection limit	0.30 ppm
3	Lead	0.0216 ppm	10 ppm
4	Mercury	0.0343 ppm	1.0 ppm

Table-5: Analysis of microbial load

S. No.	Parameter Analyzed	Results	WHO Limits
1	Total Bacterial Count	1,000 CFU / gm	105 CFU / gm
2	Total Fungal Count	Absent	103 CFU / gm
3	Enterobacteriaceae	Absent	103 CFU / gm
4	Salmonella	Absent	Absent
5	Staphylococcus aureus	Absent	Absent

Table-6: Estimation of Aflatoxins

S. No	Aflatoxins	Results
1	B1	Absent
2	B2	Absent
3	G1	Absent
4	G2	Absent

Table-7: Analysis of pesticide residue

Sl. No.	Pesticide residues	Results
1	Organo Chlorine Group	ND
2	Organo Phosphorus Group	ND
3	Acephate	ND
4	Chlordane	ND
5	Dimethoate	ND
6	Endosulphan	ND
7	Endosulfan	ND
8	Endosulfon	ND
9	Ethion	ND
10	Endosufon sulphate	ND
11	Fenthion	ND
12	Heptachlor	ND
13	Lindane	ND
14	Methoxychlor	ND
15	Phorate sulfoxide	ND
16	Phorate sulfone	ND
ND – Not detected		

3.4. Antibacterial activity and MIC

Of the 25 urine samples collected from the patients, 3 isolates were confirmed for *Escherichia coli (JZECO-1, JZECO-2, JZECO-3),* three isolates for *Klebsiella pneumoniae (JZKP-1, JZKP-2 JZKP-3)* and three were identified as *Staphylococcus saprophyticus (JZSS-1, JZSS-2, JZSS-3)* while the remaining were found to be other organisms. The advent discovery of PCR and the sequencing technology enabled the easier and accurate identification of the organism. The drug Jawarish-e-Zanjabeel exhibited higher degree of activity against all the *E.coli* isolates. *Klebsiella pneumoniae* exhibited moderate level of sensitivity whereas the *Staphylococcus saprophyticus* did not show any activity. The zone diameter varies from 20mm to 25mm in case of *E.coli* isolates and between 11mm to 15mm in case of *Klebseilla* isolates at the concentration of 50mg/ml. The MIC study revealed the MIC value as 6.25mg/ml for *Escherichia coli* whereas 1.25mg/ml for the *Klebsiella pneumoniae* (Table-VIII and Fig. 3 & 4).

Table-8: Minimum Inhibitory Concentration

S.No.	Organisms	Concentration of the drug (n = 2)			
		25 mg/ml	12.5 mg/ml	6.25 mg/ml	3.125 mg/ml
1	JZECO -1	+	+	+	-
2	JZECO-2	+	+	+	-
3	JZECO-3	+	+	+	-
4	JZKP-1	+	+	-	-
5	JZKP-2	+	+	-	-
6	JZKP-3	+	+	-	-
(+) - Presence of activity			(-) - Absence of activity		

Escherichia coli

Disc concentration
1-50 mg/ml
2-25 mg/ml
3-12.5 mg/ml
4-6.25 mg/ml
5-3.125 mg/ml

Klebseilla pneumoniae

Conclusion

The results of present investigation clearly indicate that the drug is free from Microbial growth, Heavy metals, Aflatoxins and Pesticidal residues. The Antibacterial study revealed that the drug Jawarish-e-Zanjabeel is possible source to obtain new and effective herbal medicine to treat infections caused by urinary tract pathogens.

Acknowledgement

The authors are extremely thankful to the Director General, CCRUM, New Delhi, for his valuable guidance, encouragement and providing necessary research facilities.

Reference

Anonymous, 1982. Manual of Diagnostic Procedures in Medical Microbiology and Immunology/Serology, Christian Medical College and Hospital, Tamil Nadu, pp 72-100.

Anonymous, 1987. Physico-chemical standards of Unani Formulations Part – II, CCRUM, Ministry of Health & Family Welfare, New Delhi, pp. 300-317.

Anonymous, 1996, Indian Pharmacopoeia, Microbiological assay and tests, p.p-100- 106.

Anonymous, 1998. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, pp. 25-28.

Anonymous, 2006. National Formulary of Unani Medicine, Part – I (English Edition), Govt. of India, Min. of Health & Family Welfare, New Delhi, p. 106.

Anonymous, 2000. Association of Official Analytical Chemists (AOAC), 17th Edition.

Howard C.Ansel, William P. Norred, Ivan L. Roth, 1969. Antimicrobial activity of dimethyl Sulfoxide (DMSO) against *Escherchia coli*, *Pseudomonas aeruginosa* and *Bacillus megaterium*. *Journal of Pharmaceutical Sciences* 58(7):836-839.

Koktae C. K., 2000. Practical Pharmacology, Vallabh Prakasan, Delhi, pp. 2-13.

Mackie & McCartney, 1996. Practical Medical Microbiology, Churchill Livingston Publishers.

Pulok k. Mukherjee, 2008. Quality control herbal drugs – An approach to evaluation of botanicals. Business Horizons, New Delhi, pp. 2-9.

Rakesh K Sharma and Rajesh Arora, 2006. Herbal drugs – A twenty first century perspective. Jaypee brothers, New Delhi, pp.1-2

Wagner H, Bladt S and E M Zgainski, 1984. Plant Drug Analysis, A Thin Layer Chromatography Atlas (2nd Edition). Springer-Verlag, Germany.

Development of HPTLC Fingerprints of 'Itrifal Kishneezi' : A Unani Classical Formulation

[1]Kunal Sajwan, [1]Sonali Sajwan, [1]M. A. Rashid, [1]Mustehasan, [1]R. K. Negi, [2]R. K. Pawar, [3]Nitin Rai and [2]Rajeev Kr. Sharma

1. Drug Standardization Research Institute (Unani), CCRUM, PLIM Campus, Kamla Nehru Nagar, Ghaziabad-201002, U.P., India

2. Pharmacopoeial Laboratory for Indian Medicine, Kamla Nehru Nagar, Ghaziabad, U. P.

3. Department of Botany, M.M.H. College, Ghaziabad, U. P.

Introduction

Itrifal is a semi-solid preparation where one or more single drugs of plant origin are mixed, where triphala (Halela, Balela, Amla) used as main ingredients. This Poly-herbal Unani formulation is therapeutically considered as stomachic, laxative and carminative. It is used for the treatment of bleeding piles, conjuctivites, chronic catarrah, gastric headache, etc. The ingredients used in this formulation are: Amla (*Emblica officinalis)*, Post- e-Halela Zard (*Terminalia chebula)*, Post- e- Halela Kabli (*Terminalia chebula)*, Halela Siyah (*Terminalia chebula)*, Kishneez Khushk (*Coriendrum sativum)*, Balela (*Terminalia bellerica)*. Other formulations of similar catergories viz Itrifal Zamani (Siddiqui *et al.*, 1991), Itrifal- e- mulayin (Veeresh *et al.*, 2004) and Itrifal muqil (Arfin *et al.*, 2007) have been worked out. Botanical identification of the ingredients of *Itrifal Kishneezi* was carried out by Negi *et al.* (2009). Pharmacopoeial monograph on Itrifal Mulayyan ,Itrifal Muqawwi Dimagh ,Itrifal-e-MuqilMumsik,Itrifal-e-Mus-hil,Itrifal-e-Sana,Itrifal-e-Zabeeb,Itrifal Zamani,Itrifal-e-Muqil Mulayin were published by (Annonymous, 2009; 2010).

Material and method

Itrifal Kishneezi was prepared as per National Formulary of Unani Medicine (Anonymous, 2006). All the ingredients of the formulation were procured from the Khari Baoli market of Delhi and authenticated with the help of pharmacopoeial standards (Anonymous, 2007) and finally compared with the museum samples of PLIM, Ghaziabad. The compound formulation was prepared in the laboratory as per the procedure laid in NFUM (2006).

The physico-chemical study of the drug was carried out and for HPTLC profile CAMAG HPTLC system equipped with a sample applicator Linomat V, automatic multiple Developer-2 chamber, TLC scanner 3, Reprostar-3 and Win- cats an integrated Software 4.02 (Switzerland) was used.

Formulation/Composition: *Itrifal kishneezi* is a semi- solid preparation consists of the following herbal ingredients in the composition:

Table-1

S.No.	Unani Name	Botanical Name	Part used	Quantity
1	Amla	*Emblica officinalis* Gaertn.	Fruit	100g.
2	Post-e-Halela Zard	*Terminalia chebula* Retz.	Fruit pulp	100g.
3	Post-e-Halela Kabli	*Terminalia chebula* Retz	Fruit pulp	100g.

S.No.	Unani Name	Botanical Name	Part used	Quantity
4	Halela siyah	*Terminalia chebula* Retz	Fruit	100g.
5	Balela	*Terminalia bellerica* Roxb.	Fruit pulp	100g.
6	Kishneez khushk	*Coriendrum sativum* Linn.	Fruit	100g.

Procedure: The formulation was prepared as per methodology given in NFUM (Anonymous, 2006).

Observations and Results

1A. Macroscopical/Organolaptic features of Ingredients of Itrifal Kishneezi:-

1. Amla (*Emblica officinalis* Gaertn.): Broken pieces of greyish black coloured fruit globuler with a wrinkled surface. The fruit breaks easily, exposing a section of dried pulp and nut which contains tri-gonous seeds of yellowish brown colour, odour- mild and characteristic, taste-acidic (Fig. 1A).

2. Post-e-Halela Zard (*Terminalia chebula* Retz.): Broken pieces of reddish brown fruit of various sizes, longitudinally wrinkled surface having five ribes. Odour-agrreable,Taste-astringent (Fig.1B).

3. Post-e-Halela Kabli (*Terminalia chebula* Retz.): Broken pieces of yellowish brown fruit of various sizes, wrinkled surface, having five ribes. Odour- agrreable; taste- astringent (Fig.1C).

4. Halela siyah (*Terminalia chebula* Retz.): The small sized variety of young immature fruits which are upto 2.5 cm. long and 8mm. broad Ovoid with a longitudinally wrinkled surface and black colour, Odour- None, Taste- Astringent (Fig. 1D).

5. Balela (*Terminalia bellerica* Roxb.): Broken pieces of yellowish brown fruit, surface velvetty, covered with close falvous tomentum having light amber colour (Fig.1E).

6. Kishneez khushk (*Coriendrum sativum* Linn.): Fruit ovoid or sub- globular, yellowish green in colour, external surface is covered with longitudinally running primary and secondary ridges. The former are wavy and inconspicuous while the latter are straight and prominent on whole, the fruit gives a ribbed appearance, Odour- spicy, taste-pungent and aromatic (Fig. 1F).

Amla (*Emblica officinalis* Gaertn.)

Post-e- Halela Zard(*Terminalia chebula* Retz.)

Post-e- Halela Kabli (*Terminalia chebula* Retz.)

Halela Siyah (*Terminalia chebula* Retz.)

Post- e- Balela (*Terminalia bellerica* Roxb.)

Kishneez khushk (*Coriendrum sativum.* L.)

Fig. 1: A, B, C, D, E, F - Photographs of the crude drugs

2. Physico-Chemical Analysis

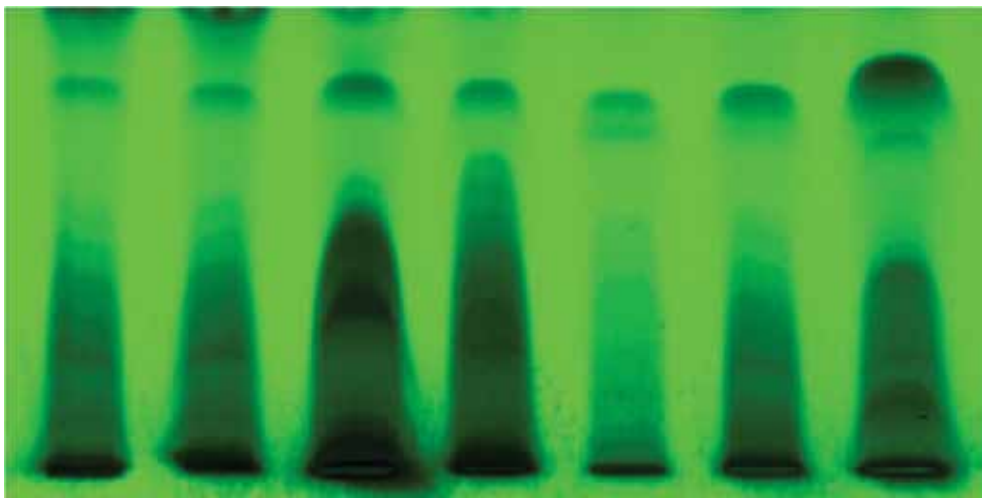
Physico-chemical analysis of compound formulation: The data obtained in study is given in Table-2.

Table-2: Physico-chemical constants

Parameter	Value
Alcohol soluble matter	27.90%
Water soluble matter	77.64%
Total ash	0.98%
Acid insoluble ash	0.065%

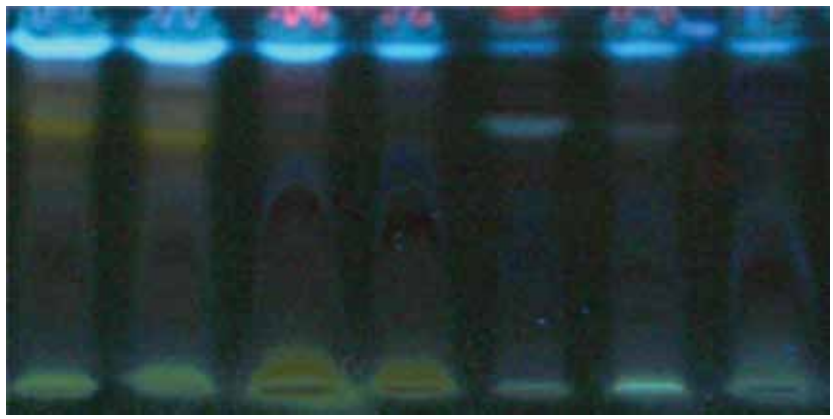
3. Thin Layer Chromatography: Five g powdered drug was extracted in 60 ml of absolute alcohol under reflux on water bath for 10 min. Filtered and concentrated the filtrate up to 4 ml. The extract obtained was applied on a pre-coated silica gel plate and developed in Ethyl acetate: Methanol: Water (100: 13.5: 10) system in developing chamber. The plate was dried and sprayed with Anisaldehyde- Sulphuric acid reagent and again the plate was dried and kept in an oven for heating at 105^0 C for 10 minutes, (Fig. 2A, B, C).

HPTLC Profile: Itrifal Kishizeezi



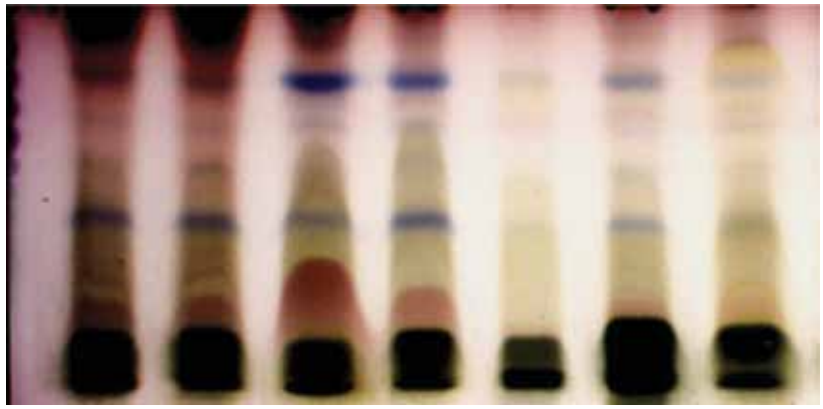
I II III IV V VI VII

UV 254 nm



I II III IV V VI VII

UV 366 nm



I II III IV V VI VII

I-Itrifal Kisnizee, II-Amla, III-Post-e-Halela Zard, IV-Post-e-Halela Kabli, V- Halela Siyah, VI- Balela, VII- Kisneez Khushk

Solvent System: Ethyl acetate: Methanol: Water (100: 13.5: 10)

Spray Reagent: Anisaldehyde-Sulphuric Acid Reagent

Fig. 2: (A, B, C)

Table-3: TLC Fingerprint Data

Ingredient / Formulation	RF Value
Amla (ingredient)	0.13, 0.39, 0.81
Post-e- Halela Zard (ingredient)	0.13, 0.23, 0.39, 0.72
Post-e- Halela Kabli (ingredient)	0.13, 0.39, 0.72
Halela siyah (ingredient)	0.1, 0.29, 0.38, 0.72

Ingredient / Formulation	RF Value
Balela (ingredient)	0.11, 0.72
Kishneez khushk (ingredient)	0.13, 0.39, 0.72
Itrifal kishneezi (formulation)	0.13, 0.23, 0.29, 0.39, 0.72, 0.81

1B. Organoleptic features of formulation: Colour- raddish brown, semisolid, sweet but slightly bitter in taste, Smell aromatic.

Conclusion

Authentification of ingredients by Macroscopy (Fig. 1), along with physico-chemical parameters (Table - 2) followed by HPTLC Profile (Fig-2, Table - 3) demonstrates the genuineness and purity of Itrifal kishneezi, that may help ensuring the quality of other indigenous medicine as well.

Acknowledgement

The authors are highly thankful to the Director General, CCRUM, New Delhi for providing necessary research facilities and Dr. G. P. Garg, Project Director D.S.R.I. (Unani), CCRUM, Ghaziabad, for continuous encouragement.

References

Anonymous, 2006. The National Formulary of Unani Medicine, Part-I, Ministry of Health and family Welfare, Govt. of India, New Delhi, pp. 94, 299, 295.

Anonymous, 2007. Unani Pharmacopoeia of India, Part-I, Vol- 1,Ministry of Health and family Welfare, Govt of India, New Delhi, pp. 102- 138.

Anonymous, 2009. Unani Pharmacopoeia of India, Part-II, Vol- I, Ministry of Health and family Welfare, Govt of India, New Delhi, pp. 20,23

Anonymous, 2009. Unani Pharmacopoeia of India, Part- II, Vol- II, Ministry of Health and family Welfare, Govt of India, New Delhi. pp. 37, 46, 48, 51.

Arfin, S., Qasim, M. A. and Khan, I. U., 2007. Physicochemical standardization of Itrifal Muqil – A Study on four different samples, Proceedings of International Conference on Unani Medicine, Central Council for Research in Unani Medicine, New Delhi, pp. 857- 859.

Kirtikar, K. R. and Basu, B. D., 1998. Indian Medicinal Plants, Vol.- II, Mahendra Pal Singh book Depot, Dehradun, pp. 1017, 1020, 1225.

Kirtikar, K. R. and Basu, B. D., 1998. Indian Medicinal Plants, Vol.- III, Mahendra Pal Singh book Depot, Dehradun, p. 2220.

Negi, K.; Singh, V. K. and Siddiqui, M. K., 2009. Ingredient identification in “Itrifal-e-Kishneezi” – A polyherbal Formulation in Unani System of Medicine. *Hippocratic Journal of Unani Medicine* **4** (1): 55- 64.

Siddiqui, S. H., Zaidi, S. T. H., Khan, G., and Sharma, H. P., 1991. Standardization of Itrifal- e- Zamani and Some of its Constituents, *Indian J. Unani Medicine* **1:** 37- 42.

Veeresh, P., Veerapur, B., Milind, S., Srinivasa, H. H., Padh, R. M., 2006. Phytochemical Evaluation of Polyherbal Unani Formulations– A Case Study of Itrifal Mulaiyin and Sharbat-e-Dinar, In : M.Z. Abdin and Y.P. Abrol (Eds.), Traditional Systems of Medicine. Narosa Publishing House, 22 Dariyaganj, New Delhi– 110002, pp. 122-130.

HIPPOCRATIC JOURNAL OF UNANI MEDICINE

Instructions to contributors

1. The paper(s) should be submitted in duplicate. Submission of a paper will be taken to imply that it is unpublished and is not being considered for publication elsewhere.

2. Papers should be written in English language and typed with double spacing on one side of A-4 size paper leaving top and left hand margin at least 1" (One inch) wide. Length of the paper should not exceed 12 pages.

3. Papers should be headed by a **title**, the initial(s) and surname(s) of author(s) followed by address.

4. Each paper should bear **abstract**, 2 to 5 **keywords, introduction, methodology, observations, results and discussion** followed by **acknowledgements and references**.

5. In all studies of plants or animals proper identification should be made as to the materials used.

6. While submitting the paper(s) for publication, Author(s) should decode the drugs specially in case of clinical studies.

7. Bibliographical references should be listed in alphabetical order of the author at the end of the paper. Authors should be cited in the text only by their surname(s) but their initial(s) should be shown in the bibliography.

8. References to periodicals should include the name(s) and initial(s) of author(s), year of publication, title of the book, periodical, title of the article, volume number (Arabic numerals), issue number where appropriate, first and last page number. Reference to books should include name(s) and initial(s) of the author(s), year of publication, exact title, name(s) of publisher, place of publication, page number.

9. References should be cited in the text in parentheses by the name(s) of author(s) followed by the year of publication, e.g. "(Jain,1991)" except when the author's name is part of the sentence, e.g. "Jain (1991) has reported that." If there are more than two authors it is in order to put " et al." after the first name, e.g., Khan et al., 1981.

10. Each table should be typed on a separate sheet of paper. Tables should be numbered consequently in Arabic numerals e.g. "Table 1, Table 2"

etc., and attached to the end of the text. Tables should be provided with headings and kept as simple as possible and should be referred to in the text as “table 1” etc.

11. Figures (including photographic prints, line drawings on strong white or transparent paper, and maps) should be numbered consequently in Arabic numerals, e.g. “Fig. 1 etc.” and attached to the text behind the tables. Graphs and diagrams should be large enough to permit reduction to a required size, legends for figures should be listed consequently on a separate sheet of paper. Photographs should be on glossy printing paper.

12. The editors reserve the right to refuse any manuscript submitted, whether on invitation or otherwise, and to make suggestions and modifications before publication.

13. Paper accepted by the editorial board will become the property of the CCRUM. No article or any part thereof may be reproduced in whatever form, without the written permission of the Editor-in-Chief.

14. The editors and publisher are not responsible for the scientific contents and statements of the authors of accepted papers.