In *Ashtanga Hridaya Beejaka* has been used as constituent drug in *Vashishtha Hareetaki* in *Kasa* [57], *Eladi Ghrita* in *Rajyakshma* [58], *Shwitra Chikitsa* [59], as *Rasayana* [60].

Nighantu Sesha has considered *Asana* and *Beejak* as synonyms. He has named *beejaka* as *Neelniryas* and mentioned its two varieties viz. *Shikhigreeva* (Best variety) and *Gomutraka (*inferior variety) [61].

***Asana/Beejaka* in Modern Ayurveda Literature:**

Asana and *Beejaka* have been considered synonymous in Ayurvedic Pharmacoepia of India and *Pterocarpus marsupium* Roxb., Fabaceae has been considered its botanical source [62].

Discussion

Literary survey of Classical texts reveals mention of two different drugs *Asana* and *Bijaka*. In classical texts *Asana* has been used both as a single drug and in poly-herbal formulations indicated for urticaria, orodental hygeine, *rasayana* etc. *Bijaka* has been indicated for anemia, skin diseases, *khalitya, palitya, rasayana, kasa, rajyakshma* etc. Asana has been said to flower in *Sharad Ritu*. In the field *Terminalia alata* Heyne ex Roth is found to flower in the month of April to May whereas *Pterocarpus marsupium* Roxb. flowers in the months of September to October. Simultaneous use of *Asana* and *Bijaka* as rasayana [39,60] in AH.U.39.152,153 reveals that both are different plant drugs. Vaidya Bapalal has considered them as two different drugs [63].

Use of two different plant drugs by their classical names *Asana* and *Vijayasasl* in local health traditions in forested villages of Kheri district of Uttar radish also favours consideration of *Asana* and *Beejaka* as two different drugs rather than considering these two terms synonymous.

Results

References of classical medicinal uses and their comparative analysis with tribal claims show that both the drugs *Asana and Beejaka are derived from two different botanical sources.*

1. *Asana* is *Terminalia alata* Heyne ex Roth, family – Combretaceae
2. *Beejaka* is *Pterocarpus marsupium* Roxb., family - Fabaceae.
3. Consideration of *Asana* and *Bijaka* as synonymous is not appropriate.

Considering *Asana* and *Bijaka* as different plant drugs provides us an opportunity to include a new plant viz. *Terminalia alata* Heyne ex Roth, Combretaceae in pharmacoepia. It is abundantly available. It is being used by the tribal people by its classical name *Asana*.

Conclusion

From the study it may be concluded the Classical drugs *Asana* and *Beejaka* are derived from two different botanical sources. *Asana* is *Terminalia alata* Heyne ex Roth, family – Combretaceae and *Beejaka* is *Pterocarpus marsupium* Roxb., family - Fabaceae. Consideration of *Asana* and *Bijaka* as synonymous by some scholars of Ayurveda and API is not appropriate.

Acknowlwdgements

We are thankful to the administration of Dudhwa National Park and Pilibhit Tiger Reserve for facilitation of this study, Dr. Kaushal Kumar, Ex. Ethnobotanist, NBRI, Lucknow and Principle, L.H. State Ayurveda College Pilibhit for their cooperation and support.

References

1. Singh KK, Flora of Dudhwa National Park, Bishen Singh Mahendra Pal Singh, Dehradun, 1996.
2. Shastri Kashi Nath, Charak Samhita Hindi Commentary, 1st part; Chaukhambha Sanskrita Sansthan Varanasi, 2000, CS.Su.4.43.
3. Shastri Kashi Nath, Charak Samhita Hindi Commentary, 1st part; Chaukhambha Sanskrita Sansthan Varanasi, 2000, CS.Su.5.73.
4. Shastri Kashi Nath, Charak Samhita Hindi Commentary, 1st part; Chaukhambha Sanskrita Sansthan Varanasi, 2000, CS.Su25.49.
5. Shastri Kashi Nath, Charak Samhita Hindi Commentary, 2nd part; Chaukhambha Sanskrita Sansthan Varanasi, 2000, CS.Ci.1.2.12.
6. Shastri Kashi Nath, Charak Samhita Hindi Commentary, 2nd part; Chaukhambha Sanskrita Sansthan Varanasi, 2000, CS.Ci.1.2.12 pg 20.
7. Shastri Kashi Nath, Charak Samhita Hindi Commentary, 2nd part; Chaukhambha Sanskrita Sansthan Varanasi, 2000, CS.Ci.1.3.3 pg 24.
8. Shastri Kashi Nath, Charak Samhita Hindi Commentary, 2nd part; Chaukhambha Sanskrita Sansthan Varanasi, 2000, CS.Ci.1.4.7 pg 37.

Original Article

Indian Journal of Ancient Medicine and Yoga
Volume 12 Number 2, April - June 2019
DOI: https://dx.doi.org/10.21088/ijamy.0974.6986.12219.3

Bakuchi: A potent herbal drug

Ramita Maharjan[1], Prabhat Kumar Srivastava[2], Priyanka Soni[3], Vinamra Sharma[4], Mahesh Kumar Mainali[5], Prema N. Mysore[6]

Author Affiliation: [1]PG Scholar, [2]Associate Professor, [3]Assistant Professor, Department of Dravyaguna, [4]Associate Professor, Department of Rasashastra and Bhaisajyakalpana, Patanjali Bharatiya Ayurvigyan evam Anusandhan Sansthan, Haridwar, Uttarakhand 249405, India. [5]H.O.D., Patanjali Yoga Literary Research Department, Patanjali Yogpeeth, Haridwar, Uttarakhand, India, [6]Director, Rishipath Healthcare, Research and Publication International Pvt. Ltd., Bangalore, Karnataka 560078, India.

Corresponding Author: Prema N. Mysore, Director, Rishipath Healthcare, Research and Publication International Pvt. Ltd., Bangalore, Karnataka 560078, India.

E-mail: ramitama@gmail.com

Received on 15.04.2019; **Accepted on** 06.06.2019

Abstract

The plant Bakuchi *Psoralea Corylifolia* L. is a very important drug mentioned in Ayurvedic, Korean and Chinese system of Medicine. The leaves, seeds, root and seed oil can be used for various ailments. The major compounds isolated from this plant are glycosides, phenols, monoterpenoids, coumarins and flavonoids which are mostly present in the seeds. The seeds and the leaves of this plant, possess a potent anti-oxidant, anti-bacterial and anti-fungal activity. It can be used in cancer, skin diseases, psoriasis, diabetes etc. It can also be used as an Estrogen receptor against and also be used for spermatogenesis. Psoralen one of the active constituent is increased in stress condition and can be used as a biomarker for plant stress in the plant Bakuchi. The plant also has radio resistant properties. It can be used as an antiviral and antiprotozoal agent in fish.

Keywords: Bakuchi; *Psoralea Corylifolia; Psoralen.*

How to cite this article:
Maharjan R, Srivastava PK, Soni P, Sharma V, Mainali MK, Mysore PN. Bakuchi: A potent herbal drug. Indian J Ancien Med Yog. 2019;12(2):47-52.

Introduction

Bakuchi botanically identified as *Cullen corylifolium* (L.) Medik. with the basionym *Psoralea corylifolia* L. belongs to the family fabaceae [1]. Its medicinal usage is reported in Indian pharmaceutical codex, the Chinese, British and the American pharmacopoeias and in different traditional system of medicines such as Ayurveda, Unani and Siddha [2]. The plant has been used in various conditions like skin diseases like leucoderma, cardiac and vascular diseases, kidney diseses like nephritis, osteoporosis and cancer [3]. The plant extracts have been reported to possess antibacterial, antitumor, antioxidant, anti-inflammatory, antifungal and immunomodulatory activity [4]. The major identified compounds of this plant belong to the group coumarins, flavonoids, and meroterpenes [5]. The major active compounds have been mostly isolated from the seeds [6].

Description [7]

Erect annual herb with unifoliolate alternate leaf. The Inflorescence is a peduncled raceme, The fruit is ovoid, glabrous, black, pitted and mucronate.

Traditional uses

It is used in Korean Traditional medicine for male

infertility and sexual dysfunction [8]. It is also used in chinese traditional medicine that is used as tonic, aphrodisiac and as a remedy for for bone fracture, osteomalacia and osteoporosis [9, 10].

Classification *[11]*

Kingdom: Plantae

Class: Equisetopsida C. Agardh

Subclass: Magnoliidae Novak ex Takht.

Superorder: Rosanae Takht.

Order: Fabales Bromhead

Family: Fabaceae Lindl.

Genus: Cullen Medik.

Phytochemicals

The fruit constitutes psoralenoside, isopsoralenoside, corylinin, isopsoralen, psoralen, sophoracoumestan A, neobavaisoflavone, methylcorylifol A, isoprenylcorylifol A, isoprenylneobavaisoflavone, isobavachromene, psoralidin, neobavaisoflavone, corylifol A, bakuchiol, coumestan, sophoracoumestan A, dihydroxybakuchiol, bisbakuchiol C, geranylisoflavone and corylifols [12-20].

The chemical composition of the leaves of the plant are isopsoralen, psoralen, isobavachalcone, bavachin, corylifol A and neobavaisoflavone, bakuchiol [21].

Uses:

In Ayurveda

In Ayurveda, it can be used for constipation, asthma, skin diseases, bleeding disorders, diabetes, fever and helminthiasis [22].

In cancer

Psoralen and isopsoralen have shown good anticancerous effect invitro in multi drug resistance cancer cells. The seed extract is also useful in ascitic tumour. The mode of action seems to be inhibition of the proliferation of cancer cells, stimulate the human immune system and activation of the antibody complement-mediated cytotoxicity [23-24].

In Skin diseases

Isopsoralen obtained from the fruit can be used in ultaviolet light therapy treatment like psoralen and ultraviolet A for various psoriasis like lesion [25]. Similarly it can be used in inhibition of the growth of papilloma, soft tissue fibrosarcomas and psoriasis [26-27].

In Diabetes

It can be used for the treatment of Type-II Diabetes mellitus in case of insulin resistance [28].

Antibacterial and Antifungal activity

The seed and root extract has potent antibacterial and antifungal activity. It has greater activity towards bacterias like *Staphylococcus aureus* and *S. epidermidis.* It has activity against fungus like *Trichophyton rubrum*, *Trichophyton mentagrophytes*, *Epidermophyton floccosum* and *Microsporum gypseum, Alternari brassicae*, *Aspergillus niger*, *Fusarium oxysporum* and *Rhizoctonia cerealis.* The phytochemicals responsible for this action may be Psoralidin, bakuchicin, psoralin, prenylflavonoid and angelicin has significant antibacterial activity [29-33].

Antioxidant activity

The phyto constituents like Psoralen, Psoralidin, bakuchiol, corylifolin, corylin, isopsoralen, Bakuchiol and psoralen present has a good antioxidant activity in decreasing order [34-37].

Reproductive function

It promotes spermatogenesis via CREM activation. Hence can be used in conditions like decreased sperm counts [38-39]. The bakuchiol and bavachin can also be used as an alternative to estrogen replacement therapy (ERT) [40-42].

Other activities

Bakuchi can be used to inhibit LPS-induced Nitric Oxide production, inhibit superoxide anion and fMLP/CB-induced elastase. It can also be *used* to inhibit CYP3A4 activity *in vitro* without cytotoxicity, hypoxia-inducible factor-1 (HIF-1) in AGS human gastric cancer cells, inhibit DGAT1/2, HIF-1 and NF-κB [43- 48].

Bioavalibility

The bioavailability of bakuchicin in mouse plasma was 58.3% at 5 mg/kg oral administration in mouse [49]. In the oral intake, for the metabolism and pharmacological effects of the extracts of this plant, the role of intestinal bacteria plays an important role [50].

Fig. 5: *Terminalia alata* Heyne ex Roth Fruiting

Fig. 6: *Pterocarpus marsupium* Roxb. Flowering

Observations

Observation of tribal system reveals use of two different plant species in traditional healthcare system viz.

Asana (*Terminalia alata* Heyne ex Roth., Combretaceae).

Vijaisal / Vijaysar (*Pterocarpus marsupium* Roxb., Fabaceae)

***Asana* in** *(Terminalia alata* Heyne ex Roth.) **Local Health Traditions:**

Asana is a big tree found mixed in Sal forest. Decoction of Bark of *Asana* is used as cardiotonic for the treatment of oedema of cardiac origin and diarrhoea. Ash obtained by burning its stem and branches is used as detergent.

Distribution – It is found mixed with *Sal Shorea robusta* in forest area.

Vijaysar (*Pterocarpus marsupium* Roxb.) in **Local Health Traditions:**

Vijaisar is used mainly for the treatment of urinary discharge and glycosurea. People use its wood to make utensils, store water in these wooden utensils and drink the same early in the morning to alleviate glycosuria and other related problems.

Distribution – It is found rarely in forest area. Planted in Kishanpur range of Dudhwa National Park.

***Asan* in Ayurveda Classics:**

In *Charak Samhita*, it has been classified in *Udard prashamana mahakashaya [2].* It has been indicated for *Dant Dhawan* to make Tooth Brush [3], for preparation of *Sarasava* [4], as *Rasayan* [5,6,7,8], in preparation of *Chandanadi Tail* in *Jwara Chikitsa* [9], in the form of *Kshar* (Alkali) in *Raktapitta* [10], in the management of *Pittaja prameha* [11], in *Kushtha chikitsa* [12,13], in *Urustambha chikitsa [14]*, said to found in *Jangal Desh* [15].

In *Sushruta Samhita Asana* is considered to flower in *Sharad Ritu* [16], in *Salsaradi Gana* [17], *Kushtha Chikita* [18], *Mahakushtha Chikitsa* [19,20], *Prameha Chikitsa* [21], its ashes in purification of contaminated water [22], in preparation of *tail* in *Jeerna Jwara Chikitsa* [23], in preparation of *Eladi ghrita* in *Shosha Chikitsa* [24], in *Raktapitta Chikitsa* [25].

In *Ashtanga Hridaya Asana* has been grouped in *Shleshma Nashak Gana* [26], *Asanadi Gana* [27], in the treatment of *Kunapa Gandhi Shukra* [28], wholesome items in *prameha* [29], *Ayaskriti* in *prameha* [30], *Kushtha Chikitsa* [31], decoction in skin disease [32], *Switra chikitsa* [33], *Ahiputana Chikitsa* [34], decoction indicated as nasal drop in diminished vision [35]; *Galganda* [36]; *Bhagandar* [37]; *Rasayan* [38,39,40,41].

In Vangsena, *Asana* has been indicated in the management of *Updamsha* [42].

Decoction of heart wood has been indicated in obesity [43].

Heart wood along with *Gomutra* has been indicated in *Shlipada* [44].

In most of the Nighantu classics, *Asan* and *Beejaka* have been considered to be synonymous [45,46,47,48,49,50].

***Beejaka* in Ayurveda Classics:**

In *Charak Samhita Beejaka* has been used for the preparation of *Beejakadyarishta* for the management of *Pandu* [51].

In *Sushruta Samhita Beejaka* has been considered as best drug for *Kushtha* along with *Khadir* like *Vrikshaka* and *Arushkar* in *Arsha* [52], decoction for bathing in *Kushtha* [53], as a constituent drug of *Neeli Tail* & *Saireyakadi Tail* in *palit rog.* [54]; as *Rasayan* for vision and longevity [55]; constituent of *Muktadya Anjana* [56].

Map 1: Area of Study

Fig. 1: *Terminalia alata* Heyne ex Roth *Flowering*

Fig. 2: *Pterocarpus marsupium* Roxb. Flowering

Fig. 2: *Terminalia alata* Heyne ex Roth Fruiting

Fig. 4: *Pterocarpus marsupium* Stem exudates

Invitro studies

The calluses grown under stress as continuous illumination and seeds exposed to higher gamma doses possessed higher isoflavones production and antioxidant activity [51]. Increased psoralen production can be used as a stress biomarker in the plant. It can be increased by increasing variable doses of gamma rays as a stress factor. The production of *invitro* psoralen can be increased by use of jasmonic acid as an elicitor [52-54].

The seeds of this plant are also radio resistive. The mild doses of gamma irradiation is an important abiotic-elicitor for enhancing the oil content and phyto constituents in the plant [55-55].

The *invitro* regeneration of the plant can be done through enriched cotton moistened-liquid and solid culture systems [56].

Novel technology use

Ultra high pressure liquid chromatography tandem mass spectrometry method can be used for establising simultaneous quantification of the components, neobavaisoflavone, bavachin, isobavachalcone, bavachinin and corylifol A in rats plasma [57].

High-speed counter-current chromatography (HSCCC) can be used to separate out the active components in the plant with maximum purity. The components that were separated are psoralen, isopsoralen, psoralidin, corylifol A, bavachinin in a single run [58-59].

Use in aquaculture

Bavachin can be a promising agent to treat SVCV (spring viraemia of carp virus) infection in aquaculture company [60]. Psoralidin can be used against the parasite (Ichthyophthirius multifiliis) residing on the external surface of the fish that is causing a significant loss to aquaculture industry [61].

Conclusions and Recommendations

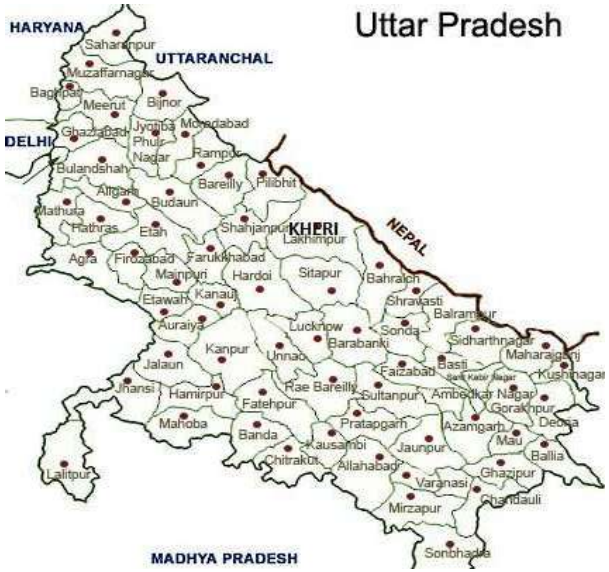
Hence, Bakuchi is a very important plant that is used in various system of medicine. The seeds are used for vitiligo for repigmentation in Ayurveda. The active component Psoralen has also been isolated from seeds that is used for PUVA (Psoralen + Ultraviolet A) therapy for pigmentation in leucoderma. Various active phytochemicals like courmarins, phenols, flavonoids etc. are responsible for treating diseases like cancer, skin diseases, diabetes etc. It can be used in person suffering from low sperm count and uterine disorders. It can be used as a potent anti-inflammatory agent. It is also radio resistant. So, it can be a new paradigm for research for those diseases that are caused due to radiations. It should be used cautiously as it may cause drug–dietary supplement interaction.

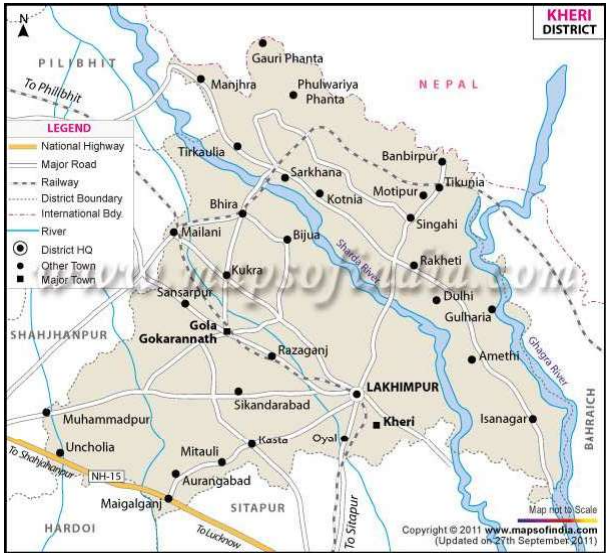
Hence the components present in this plant might serve as a potent lead compound for developing novel agents in the years to come.

References

1. http://www.theplantlist.org/tpl1.1/record/ild-30228; (Retrieved on 04-09-2018)
2. Nabi NG, Shrivastava M. Endangered Medicinal Plant Psoralea corylifolia: Traditional, Phytochemical, Therapeutic Properties and Micropropagation. UKJPB. 2017;5(1):40-46.
3. Zhang x, Zhao w, Wang Y, Lu J, Chen X. The Chemical Constituents and Bioactivities of Psoralea corylifolia Linn.: A Review. Am J Chin Med . 2016; 44(01):35-60.
4. Chopra B, Dhingraa AK, Dhingraa AK, Dhar KL. Psoralea corylifolia L. (Buguchi) – Folklore to modern evidence: Review. Fitoterapia. 2013;(90): 44-56.
5. Alam F, Khan GN, Asad MHHB. Psoralea corylifolia L: Ethnobotanical,biological, and chemical aspects: A review. Phytother Res. 2018;32(4):597-615.
6. Zhang X, Zhao W, Wang Y, Lu J, Chen X. The Chemical Constituents and Bioactivities of Psoralea corylifolia Linn.: A Review. Am J Chin Med. 2016;44(1):35-60.
7. http://www.efloras.org/florataxon.aspx?flora_id=5&taxon_id=200012290; Retrieved on 04-02-2019.
8. Yang WM , Chang MS , Park SK . Effects of Psoralea corylifolia on the cAMP-responsive element modulator (CREM) expression and spermatogenesis in rats. J Ethnopharmacol. 2008;117(3):503-06.
9. Yang X, Li J, Wang X, Fang W, Bidochka MJ, She R, Xiao Y, Pei Y. Psc-AFP, an antifungal protein with trypsin inhibitor activity from Psoralea corylifolia seeds. Peptides. 2006;27(7):1726-31.
10. D Xin. Phytoestrogens from Psoralea corylifolia reveal estrogen receptor-subtype selectivity. Phytomedicine. 2010;17(2):126-31.
11. http://www.tropicos.org/Name/13049536; Retrieved on 04-02-2019
12. Qiao CF, Han QB, Mo SF, Song JZ, Xu LJ, Chen SL, Yang DJ, Kong LD, Kung HF, Xu HX. Psoralenoside and isopsoralenoside, two new benzofuran glycosides from Psoralea corylifolia. Chem Pharm Bull (Tokyo). 2006;54(5):714-6.

13. Ruan B, Kong LY, Takaya Y, Niwa M. Studies on the chemical constituents of Psoralea corylifolia L. J Asian Nat Prod Res. 2007 Jan-Feb;9(1):41-4.
14. Ma S. Prenylflavone derivatives from the seeds of Psoralea corylifolia exhibited PPAR-γ agonist activity. Phytochem Lett . 2016;16:213-218.
15. Chena C, Hwang TL, Chen L,Chang TH, Chun SW, JungChen Jih. Isoflavones and anti-inflammatory constituents from the fruits of Psoralea corylifolia, Phytochemistry. 2017;143:186-93.
16. Yeol Oh Ket al. Glycosidase inhibitory phenolic compounds from the seed of Psoralea corylifolia . Food Chemistry. 2010;121(4):940-945.
17. Gupta S. Jha BN, Gupta GK, Dhara KL. Coumestans from seeds of Psoralea corylifolia. Phytochemistry. 1990;29(7):2371-73.
18. Wu CZ et al. Hypoxia-inducible factor-1 and nuclear factor-κB inhibitory meroterpene analogues of bakuchiol, a constituent of the seeds of Psoralea corylifolia.Bioorganic & Medicinal Chemistry Letters. 2008;18(8):2619-23.
19. Lin X et al. Four new compounds isolated from Psoralea corylifolia and their diacylglycerol acyltransferase (DGAT) inhibitory activity. Fitoterapia. 2018;128:130-34.
20. Yin S, Fan CQ , Wang Y , Dong L , Yue JM. Antibacterial prenylflavone derivatives from Psoralea corylifolia, and their structure–activity relationship study. Bioorganic & Medicinal Chemistry. 2004;12(16):4387-92.
21. Xin D et al. Phytoestrogens from Psoralea corylifolia reveal estrogen receptor-subtype selectivity. Phytomedicine. 2009;17(2):126-31.
22. Chunekar KC. Bhavaprakasha Nighantu. Rep. ed. Varanashi, India: Chaukhamba Bharati Academy; 2015.
23. Wang Y, Hong C, Zhou C, Xu D, Qu HB. Screening Antitumor Compounds Psoralen and Isopsoralen from Psoralea corylifolia L. Seeds. Evid Based Complement Alternat Med. 2011.
24. Latha PG, Evans DA, Panikkar KR, Jayavardhanan KK. Immunomodulatory and antitumour properties of Psoralea corylifolia seeds.Fitoterapia. 2000;71(3): 223-31.
25. Alalaiwe A. The active compounds derived from Psoralea corylifolia for photochemotherapy against psoriasis-like lesions: The relationship between structure and percutaneous absorption European Journal of Pharmaceutical Sciences. 2018;124(1): 114-26.
26. Latha PG, Panikkar KR. Inhibition of chemical carcinogenesis by Psoralea corylifolia seeds .Journal of Ethnopharmacology. J Ethnopharmacol. 1999 Dec 15;68(1-3):295-8.
27. Swarna A. Synergistic effect of Indigeneous medicinal plants on Psoriasis. International. Journal of Phytopharmacy. 2013;3(10):7439.
28. Tayadea PM. Jagtap SA. Borde S. Chandrasekar N. Joshi A. Effect of Psoralea corylifolia on dexamethasone-induced insulin resistance in mice. JKSUS. 2012;24(3):251-255.
29. Khatune NA, Islam ME, Haque ME, Khondkar P, Rahman MM. Antibacterial compounds from the seeds of Psoralea corylifolia.Fitoterapia. Fitoterapia. 2004 Mar;75(2):228-30.
30. Siva G et al. Optimization of elicitation condition with Jasmonic Acid, characterization and antimicrobial activity of Psoralen from direct regenerated plants of Psoralea corylifolia L..Biocatalysis and Agricultural Biotechnology. 2015;4(4):624-31.
31. Yin S, Fan CQ, Wang Y, Dong L, Yue JM. Antibacterial prenylflavone derivatives from Psoralea corylifolia, and their structure–activity relationship study. Bioorg Med Chem. 2004 Aug 15;12(16):4387-92.
32. Rajendra Prasad N, Anandi C, Balasubramanian S, Pugalendi KV. N Rajendra Prasada, CAnandi, S Balasubramanian, KVPugalendia. Antidermatophytic activity of extracts from Psoralea corylifolia (Fabaceae) correlated with the presence of a flavonoid compound.Journal of Ethnopharmacology. 2004 March;91(1):21-24. https://doi.org/10.1016/j.jep.2003.11.010.
33. Yang X, Li J, Wang X, Fang W, Bidochka MJ, She R, Xiao Y, Pei Y. Psc-AFP, an antifungal protein with trypsin inhibitor activity from Psoralea corylifolia seeds. Peptides. 2006 Jul;27(7):1726-31.
34. Jan S, Parween T, Siddiqi TO, Mahmooduzzafar. Anti-oxidant modulation inresponse to gamma radiation induced oxidative stress in developing seedlings of Psoralea corylifolia L. J Environ Radioact. 2012 Nov;113:142-9.
35. Jiangning, Guo & Weng, Xinchu & Hou, Wu & Qinghua, Li & Kaishun, Bi. Antioxidants from a Chinese medicinal herb-Psoralea corylifolia L. Food Chemistry. 2004;91:287-92.
36. Kim KA, Shim SH, Ahn HR, Jung SH. Protective effects of the compounds isolated from the seed of Psoralea corylifolia on oxidative stress-induced retinal damage.Toxicol Appl Pharmacol. 2013 Jun 1;269(2):109-20.
37. Xiao G, Li G, Chen L, Zhang Z, Yin JJ, Wu T, Cheng Z, Wei X, Wang Z. Isolation of antioxidants from Psoralea corylifolia fruits using high-speed counter-current chromatography guided by thin layer chromatography-antioxidant autographic assay.J Chromatogr A. 2010 Aug 20;1217(34):5470-6.
38. Yang WM, Chang MS, Park SK. Effects of Psoralea corylifolia on the cAMP-responsive element modulator (CREM) expression and spermatogenesis in rats. J Ethnopharmacol. 2008 May 22;117(3):503-6.
39. Wei SM, Yan ZZ, Zhou J. Psoralea corylifolia protects against testicular torsion/detorsion-induced ischemia/reperfusion injury. J Ethnopharmacol. 2011 Sep 1;137(1):568-74.





Methodology

To address issue of botanical identity of *Asana* and *Bijaka*, a two tier study was designed during the Ph.D. research study entitled "A Comprehensive Study on Medicinal Plantlore of Kheri District of Uttar Pradesh in Perspectives of Ayurveda". A field survey regarding Medicinal Plant-lore was conducted in the study area using plant utilization questionnaire. Findings of survey were documented and analysed. Plants reported to be used in Local Health Traditions were identified and collected. Herbaria were prepared. A literary survey was carried out to authenticate folk claims. Finding of field study regarding utilization patterns of medicinal plants in the Local Health Tradition were critically analyzed in perspectives of classical texts of Ayurveda.

Area of Study: Kheri District of Uttar Pradesh

District Kheri is situated in terai region of Uttar Pradesh in foothills of Himalayas. Major area is covered by thick Sal forest. Forested area of Kheri district is inhabited by two important tribal communities viz. *Tharu* and *Bhoxa*. *Tharu* tribes have a well organised social order. Tribal medicine men "*Bharra*" is responsible to look after the health of the community. They collect herbs from the forests and use them in fresh form for healing purposes. A great system of traditional healing is still in practice. Flora of Dudhwa National Park reports 821 species of Angiosperms representing 490 genera and 120 families [1]. It is home to a large number of rare and endangered animal species also [1].

40. Weng ZB, Gao QQ, Wang F, Zhao GH, Yin FZ, Cai BC, Chen ZP, Li WD. Positive skeletal effect of two ingredients of Psoralea corylifolia L. on estrogen deficiency-induced osteoporosis and the possible mechanisms of action. Mol Cell Endocrinol. 2015 Dec 5;417:103-13.
41. Liu X et al. Psoralidin, a coumestan analogue, as a novel potent estrogen receptor signaling molecule isolated from Psoralea corylifolia. Bioorg Med Chem Lett. 2014 Mar 1;24(5):1403-6.
42. Xin D, Wang H, Yang J, Su YF, Fan GW, Wang YF, Zhu Y, Gao XM. Phytoestrogens from Psoralea corylifolia reveal estrogen receptor-subtype selectivity.Phytomedicine. 2010 Feb;17(2):126-31.
43. Xiao, Guodong, Xiang-kun Li, Tao Wu, Zhi-hong Cheng, Qingjiu Tang and Tong Zhang. Isolation of a new meroterpene and inhibitors of nitric oxide production from Psoralea corylifolia fruits guided by TLC bioautography. Fitoterapia. 2012;83(8): 1553-7 .
44. Chena C, Hwang TL, Chen L,Chang TH, Chun SW, JungChen Jih. Isoflavones and anti-inflammatory constituents from the fruits of Psoralea corylifolia. Phytochemistry. 2017;143:186-93.
45. Liu Y, Flynn TJ. CYP3A4 inhibition by Psoralea corylifolia and its major components in human recombinant enzyme, differentiated human hepatoma HuH-7 and HepaRG cells. Toxicol Rep. 2015 Mar 23;2:530-34.
46. Cheng-Zhu Wu et al. Bisbakuchiols A and B, novel dimeric meroterpenoids from Psoralea corylifolia. Tetrahedron Letters. 2007;48(50):8861-64.
47. Lin X et al. Four new compounds isolated from Psoralea corylifolia and their diacylglycerol acyltransferase (DGAT) inhibitory activity. Fitoterapia. 2018 Jul;128:130-134.
48. Wu CZ, Hong SS, Cai XF, Dat NT, Nan JX, Hwang BY, Lee JJ, Lee D. Hypoxia-inducible factor-1 and nuclear factor-kappaB inhibitory meroterpene analogues of bakuchiol, a constituent of the seeds of Psoralea corylifolia. Bioorg Med Chem Lett. 2008 Apr 15;18(8):2619-23.
49. Jo JH, Kim JH, Lee HS, Jeong GS, Lee JM, Lee S. Investigation of pharmacokinetic parameters of bakuchicin isolated from Psoralea corylifolia in mice. Fitoterapia. 2017 Jul;120:194-98.
50. Wang YF, Liu YN, Xiong W, Yan DM, Zhu Y, Gao XM, Xu YT, Qi AD. A UPLC-MS/MS method for in vivo and in vitro pharmacokinetic studies of psoralenoside, isopsoralenoside, psoralen and isopsoralen from Psoralea corylifolia extract. J Ethnopharmacol. 2014;151(1):609-17.
51. N. Shinde, Amit & Malpathak, Nutan & Fulzele, Devanand. Determination of isoflavone content and antioxidant activity in Psoralea corylifolia L. callus cultures. Food Chemistry. 2010;118:128-32.
52. Jan S, Parween T, Siddiqi TO, Mahmooduzzafar. Anti-oxidant modulation in response to gamma radiation induced oxidative stress in developing seedlings of Psoralea corylifolia L. J Environ Radioact. 2012 Nov;113:142-9.
53. Govindarajan S et al. Optimization of elicitation condition with Jasmonic Acid, characterization and antimicrobial activity of Psoralen from direct regenerated plants of Psoralea corylifolia L. Biocatalysis and Agricultural Biotechnology. 2015; 4.
54. Jan S, Parween T, Siddiqi TO, Mahmooduzzafar. Anti-oxidant modulation in response to gamma radiation induced oxidative stress in developing seedlings of Psoralea corylifolia L. J Environ Radioact. 2012 Nov;113:142-9.
55. Mohsin T, Choudhary S, Ansari MYS, Aslam M, Dar SA. Ameliorative response of some essential oil furanocoumarins and proteins from Psoralea corylifolia against gamma-irradiation induced oxidative stress. Industrial Crops and Products. 2015;76.
56. P. Baskaran, N. Jayabalan. An improved protocol for adventitious shoot regeneration and plant formation in Psoralea corylifolia L. Scientia Horticulturae. Short communication. 2009 Dec 15;123(2):283-86. https://doi.org/10.1016/j.scienta.2009.08.012Get rights and content
57. Gao Q, Xu Z, Zhao G, Wang H, Weng Z, Pei K, Wu L, Cai B, Chen Z, Li W. Simultaneous quantification of 5 main components of Psoralea corylifolia L. in rats' plasma by utilizing ultra high pressure liquid chromatography tandem mass spectrometry. J Chromatogr B Analyt Technol Biomed Life Sci. 2016 Feb 1;1011:128-35.
58. Xiao G, Li G, Chen L, Zhang Z, Yin JJ, Wu T, Cheng Z, Wei X, Wang Z. Isolation of antioxidants from Psoralea corylifolia fruits using high-speed counter-current chromatography guided by thin layer chromatography-antioxidant autographic assay. J Chromatogr A. 2010 Aug 20;1217(34):5470-6.
59. Liu R, Li A, Sun A, Kong L. Preparative isolation and purification of psoralen and isopsoralen from Psoralea corylifolia by high-speed counter-currentchromatography. J Chromatogr A. 2004 Nov 19;1057(1-2):225-8.
60. Cheng C et al. Highly efficient inhibition of spring viraemia of carp virus replication in vitro mediated by bavachin, a major constituent of psoralea corlifonia Lynn. Virus Res. 2018 Aug 15;255:24-35.
61. Song K, Ling F, Huang A, Dong W, Liu G, Jiang C, Zhang Q, Wang G. In vitro and in vivo assessment of the effect of antiprotozoal compounds isolated from Psoralea corylifolia against Ichthyophthirius multifiliis in fish. Int J Parasitol Drugs Drug Resist. 2015 Apr 21;5(2):58-64.