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Review Article

A COMPARATIVE EVALUATION AND UNDERSTANDING OF THE TAXONOMICAL CHARACTERISTICS, PHARMACOLOGICAL ATTRIBUTES, AND THERAPEUTICAL POTENTIAL OF TULASI (OCIMUM SANCTUM LINN. LINN.) AND BHUSTRINA (HYPTIS SAUVEOLANS (LINN.) POIT.)

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ABSTRACT

Usage of medicinal plants as a source for medicine has been the base of Ayurveda and has been in practice since the Vedic period. This has been a driving force for exponential growth and globalization of the science through ages into what we face in the current generation. Increased demand of a drug ultimately leads to over exploitation of the drug and brings forward the risk of shortage, abuse, and unavailability of the drug. The issue of unavailability of a drug has been prevailing since the 16th century AD and to overcome these issues, various classical literatures like *Yoga ratnakara* have stressed on the concept of *Abhava pratinidhi Dravya* or substitutes. With each passing day, newer and newer pharmaceutical products are being introduced into the market utilizing the available resources, hence the necessity of introducing and replacing endangered and risky medicinal plants have become inevitable to balance out the ecosystem. *Tulasi* (*Ocimum sanctum Linn.* Linn.) is an Ayurvedic drug used in clinical practice, pharmaceutical industries, and clinical applications for their diverse and potent pharmacological activities. Even though *Tulasi* naturally grows as a weed, excessive usage, Harsh climatic conditions, and demand for its antimicrobial activity has put *Tulasi* at risk for its availability. This study is focused on another drug *"Bhustrina"- Hyptis sauveolans Poit* which also belongs to *Lamiaceae* family and is a common weed. The study mainly emphasizes to evaluate and understand and compare the similarity in taxonomical characteristics, Pharmacological attributes, and therapeutical potential of *Tulasi* and *Bhustrina* and thereby include *Bhustrina* as a potential replacement for *Tulasi*.

INTRODUCTION

Ayurveda since its dawn has advocated the usage of medicinal plants for treatment as well as for formulation of compound medicines to combat various health conditions. Mankind has always relied on plants for this purpose as well. When the herbal drugs are continuously being used and utilized for medicines continuously for decades, there arise some unavoidable and eventual consequences like over exploitation, deforestation, loss of habit etc., and the availability of these drugs starts to fall.

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This brings forward the serious topics of vulnerability, threat of being endangered or even extinction into discussion. Looking at the distribution of flora across the world, India is blessed with one of the richest variety of floras and there are hundreds and thousands of species of plants which possess the same quality to that of the commonly used plants or even superior to those in common use[1].

According to modern pharmacognosy, substitution is the replacement of a genuine drug/object with an entirely different object/herb to be used/sold in place of the genuine drug.

Day-by-day, the demand for Ayurvedic drugs in the production and manufacture industry is increasing and the drug population is drastically decreasing which forces the drug suppliers to adulterate the genuine drugs to meet the demand. The adulteration can happen at various levels starting from improper

identification of the raw drugs to intentional replacement of the genuine drugs with inferior plants. This problem of adulteration and increased drug demand can be tackled by understanding the concept of substitution and substituting the drugs with another plant or plant species which possesses qualities similar or superior to the endangered drug.

The concept of substitution has been long before mentioned in Ayurvedic classical literatures like samhitas and Nighantus like *Astanga Hridaya*[2], *Sharangadhara samhita, Bhaishajya ratnavali, Yogaratnakara'*[3,4] etc. Astanga Hridaya mentions about the concept of Substitution in *Sustra sthana,* 15th chapter, *Shodhanadi gana adhyaya*. That in the absence or unavailability of a drug in a particular *Gana*, another drug with similar property can be used in double the quantity[5]. *Bhaishajya ratnavali* which was written in 16th-17th century AD has clear cut mentioning of the replacement of a drug in its absence by another drug possessing similar qualities[6]. Various *Acharyas* have specifically told the number of *Abahva pratinidhi dravyas* also in the respective treatises. *Bhaishajya ratnavali* mentions 47 substitutes*, Acharya Bhavamishra* and *Yogaratnakara* mentions 61 and 70 substitutes respectively.

This literary review focuses and aims to understand the need for substituting high requirement medical drugs like *Tulasi* with cheap and easily available drugs like *Bhustrina*, belonging to the same family thereby providing a reliable alternative that would in turn protect the population of *Tulasi* and ultimately helps to increase the drug population back to its normalcy.

AIM

The main aim of the study is to do a comparative literary study on taxonomical characteristics, Pharmacological attributes, and therapeutic potential of *Tulasi (Ocimum sanctum Linn. Linn.)* and *Bhustrina (Hyptis sauveolans Poit.)* and evaluate the possibility of the drug Bhustrina acting as a replacement option for *Tulasi*.

MATERIALS AND METHODS

Relevant associated portions and sections of all Ayurvedic classical literatures including S*amhitas, Nighatntus*, regional Ayurvedic textbooks and various Ayurvedic compilation texts were referred to collect Ayurvedic literature on the drugs *Tulasi* and *Bhustrina*. Information regarding the drugs, their properties, therapeutical actions, and research activities conducted on the drugs were carefully evaluated and included from reliable sources.

Table 1: Drugs with their botanical name, family and part used

SlNo:	Drug	Botanical name	Family	Part Used
1.	*Tulasi*	*Ocimum sanctum Linn.* Linn.[7]	Lamiaceae	Whole plant
2.	*Bhustrina*	Hyptis suaveolens Poit.(8)	Lamiaceae	Whole Plant

Table 2: Synonyms of *Tulasi* and *Bhustrina* based on their pharmacological activity

Tulasi[9]	***Bhustrina***[10]
Bhutakeshi	*Bhuti*
Bhutaghni	*Bhutika*
Shulaghni (bha.pr)	*Pumstvanashana*
Surasa	*Sugandha*
Kayastha	
Bahumanjari	

The synonyms *Bhutagni, Bhutakeshi, Bhuti, Bhutika* represents the anti-microbial action of the drug, which is present in both the drugs as per the synonyms mentioned in the *Nighantus*. Critical understanding of the synonyms based on their morphology and pharmacological activity reflects their resemblance in appearance and pharmacologic potential of both the drugs.

Table 3: Pharmacological properties of the drugs

Drug	***Rasa***	***Guna***	***Virya***	***Vipaka***
Tulasi[11]	*Tikta Katu (Ma.Ni)*	*Ushna, Ruksha, Ladhu (Dha.ni)* *Ushna (Ra.Ni)*	*Ushna*	*Katu*
Bhustrina[12,13]	*Katu, Tikta* *Katu (Charaka)*	*Laghu, Ruksha.(dha.ni)* *Tikshna, Ushna, Laghu (Kai.Ni)* *Teekshna, Ushna (Priya Nighantu)* *Ruksha, Ushna (Charaka)*	*Ushna*	*Katu*

Table 4: Morphological Characteristics of the drugs

***Tulasi*[14]**	***Bhustrina*[15]**
Erect, branched, softly pubescent under shrub 30-60cm high.	Glandular hairy tall herb with a sweetly aromatic smell. Common weed.
Leaves are simple, opposite, elliptic, oblong, obtuse or acute with serrate or dentate margin, pubescent on both sides, petioles slender and hairy. Aromatic, branched.	Leaves are simple, up to 7*6 c, broadly ovate, rounded or sub cordate at the base, obtusely acute at the apex, densely pilose at the base, petioles upto 4.5cm long.
Flowers, tiny purplish in elongate racemes in close whorls, stamens exerted upper pair with a small, bearded appendage at the base.	Flowers axillary in cymose racemes or in fascicles, small, blue, unilateral axillary, or terminal clusters.
Fruit – Nutlets smooth, not mucilaginous when wetted	Fruit–nutlets blackish brown, ovoid, compressed.

The concept of substitution always revolves around the similarity in the pharmacological properties and therapeutical efficacy of two drugs with little importance or priority given to the physical resemblance between the drugs. The degree of similarity to the original drug determines the applicability and inclusion of these drugs under the category of possible substitutes. But in many cases , two drugs belonging to the same family often have similar morphological characteristics along with the chance of having similar pharmacological and therapeutic activity. In the case of *Tulasi* and *Bhustrina*, both the drugs belong to the family *Lamiaceae* with similarities in both pharmacological properties, morphological characteristics and appearance.

Table 5: Pharmacological actions of *Tulasi* and *Bhustrina*

Actions	***Tulasi*[16]**	***Bhustrina*[17,18]**
Dosha	*Kaphavatahara Kaphahara, Pittakrit*	*Kaphavatahara Kaphahara, Pittakrit*
Dhatu		*Avrishya, Raktapittakara*
Mala		*Bahuvitkah*
Agni	*Dipana*	*Dipana*
Ama		
Srotas		
Indriya	*Ruchya*	*Rochana, Chakshushya*
Budhi		
Sthanam		
Avayavam	*Hridya, Vakrasodhana*	*Vaktrasodhana*
Sarva Sareeram		

Pharmacological actions of the drug are an indicative of the therapeutical potential of the drug itself, by understanding and assessing the action of the drugs on *Doshas, Dhatu, Agni mala* etc, it is possible to assess the similarity in the therapeutical potential of both the drugs and reasoning the usage of *Bhustriuna* as successful substitute for the drug *Tulasi*.

Table 6: Therapeutic Indication of the Drugs

***Tulasi* [19]**	***Bhustrina* [20,21]**
Krimi	*Kasa*
Kustha	*Krimi*
Kasa	*Chardi*
Visha	*swasa*
Parshwaruja	*Kaphaja* diseases
Swasa	*Dadru kusta*
Hikka	*Bastiroga*
Mutrakrichra	*Bastiruja*

Looking at the literary references of both the drugs through all the available and modern ayurvedic literatures, it is evident that both the drugs have wide application in therapeutics and is indicated in various diseases. The therapeutic indication of both these drugs includes diseases caused due to microorganisms, skin diseases, respiratory disorders etc.

Table 7: Major Chemical Constituents of the Drugs *Tulasi* and Bhustrina

***Tulasi*[24,25]**	***Bhustrina*[22,23]**
Essential oil (Caryophyllene, camphene) Xylose, Polysacharides.	Diterpenes: Suaveolic acid, Suavelol, methyl suaveolate
Flavanoids, alkanoids, tannins, saponins	Steroids: Beta sitosterol, Beta- Sitosterol glycoside
Phenols, terpenoids, triterpenoids, steroils,	Phenolic compounds: Rosmarinic acid, Methyl rosmarinate.
Fatty acids	Alkaloids
Sitosterol	Flavanoids
Anthocynins Ursolic acid	Triterpenoids, Steroids, Sesquiterpene
Sesquiterpene	Tanin, Phenolic compounds
Chlorophyll	Chlorophyll A, Chlorophyll B, Carotenoids.
Caryophyllene.	Oleanolic acid, ursolic acid.
Rosamaric acid, eugenol.	B- caryophyllene.
Stigmasterol,	Major glycosides and tannins.
Beta sitosterol	Xylose, Polysaccharides, carbohydrates.

The major pharmacological properties and actions exhibited by the drug depend on various factors involved, among these factors, secondary metabolites or the phytochemical constituents present in the drug perform a major role. The nutritional and pharmacological profile of the drug can entirely be found out, assessed or determined by thorough study of the phytochemical constituents. The synergistic interaction between various active phytochemical constituents can influence and open the possibilities of various diverse pharmacological activities. The pharmacological profile of both the drugs are assessed to find out the major phytochemical constituents in both these drugs from all available authentic sources established through phytochemical and analytical studies.

Table 8: Analytical Standards of *Hyptis suaveolans (Linn.)Poit* in Comparison to *Tulasi*

Parameters	**% ww composition (*Bhustrina*)[26]**	***Tulasi* [27]**
Total Ash	9.9%	Not more than 19%
Water soluble ash	1.67%	Not more than 13%
Acid insoluble ash	6.39%	Not more than 3%
Alcohol insoluble ash	0.69%	Not more than 6%

Table 9 : Proved major pharmacological activity of the drugs *Tulasi* and *Bhustrina*

Pharmacological Activity	***Tulasi***	***Bhustrina***
Antimicrobial activity	Yes[28,29,30]	Yes [31,32]
Immunomodulator Activity	Yes [33]	Yes [34,35]
Anti-fungal activity	Yes [36]	Yes [37]
Antioxidant activity	Yes [38]	Yes [39,40]
Antipyretic activity	Yes[41]	Yes[42]

DISCUSSION

This review was aimed to provide a clear understanding on the similarity of taxonomical characteristics, pharmacological activity, properties, and therapeutic potential of drugs *Tulasi* and *Bhustrina. Tulasi* has been used widely used as a single drug and ingredient in various compound formulations in Ayurveda which has further led to the threat of the drug being exploited because of its therapeutic

potential. *Hyptis suaveolans Linn. Poit/Bhustrina* is an invading plant seen throughout tropical and sub-tropical regions of the country growing as a weed, belonging to the same family as *Tulasi*. The plant Hyptis suaveolans (Linn.) Poit is considered a native of the tropical America but spread gradually throughout the world even earning the plant the title of Pantropical weed[43]. Even though the drug is regarded as a weed, the drug exhibits various pharmacological activities as well as houses many important phytochemical constituents enhancing and out reaching its therapeutic potential and applications.

Global markets are filled with synthetic antibiotics intended for clinical therapy and the need for natural herbs that has potent antibiotic and antimicrobial activity has risen rapidly due to various infective diseases and epidemics that have gripped humanity in the past century. To understand about the therapeutic potential of such medicinal herbs, phytochemical and analytical studies have to be carried out and their pharmacological activities assessed thoroughly.

With respect to the Ayurveda classical literatures as well as various modern Ayurveda literatures, Bhustrina /Hyptis suaveolans Linn. Poit has been compared to *Tulasi* in this study to know about its potential to be applied as a substitute for the latter. On comparison of the synonyms, it is evident that both of the drugs have been given similar synonyms based on their pharmacological activity referring specifically to antimicrobial action and also based on similarity in their organoleptic characteristics.

In terms of *Rasa panchaka* of both drugs, both of the drugs possess *Katu* and *Tikta rasa, Katu vipaka* and *Ushna virya*. Even though minor opinion changes have been mentioned in the context of *Guna,* both of the drugs possess *Ushna, Ruksha* and *Laghu guna.* This similarity between the two drugs can even be seen in their morphological characteristics considering both drugs belonging to the same family. Both of the drugs are herb/undershrub in habit and possess similarity in case of leaves, flowers and fruits, both of the drugs also have a pleasing aroma.

Taking into considerations, the pharmacological properties in terms of action of drugs on *Dosha, Dhatu*, *Agni* etc, similarity can be visualized in this aspect also. Both the drugs are *Kaphavatahara* and *Pittakrit* and *Dipana* in nature.

The phytochemical profiles of both the drugs have been compared and major similarities have been found in the phytochemical profile as well. Both drugs are abundant in chemical constituents like flavonoids, sterols, triterpenoids and essential oils which could very well be associated to various pharmacological activities exhibited by both drugs. The essential oils present in the drugs are responsible for the antimicrobial and antifungal activity. Phenolics present in the drugs can attribute to their antioxidant activity and ursolic acid which is one of the major terpenoids present in the drugs. The major pharmacological activities discussed in the article could very well be attributed to the presence of potent chemical constituents in the plant.

On comparing the proved pharmacological activities of both drugs, the activities emphasized and considered were mainly in accordance with their traditional and well-known uses. Both drugs possess antimicrobial, antifungal, antipyretic, immunomodulatory, and antioxidant activity rendering both the drugs as an efficient choice for various infectious diseases as well as modern lifestyle disorders pertaining to various bodily systems. The therapeutic potential of the drug established through its proven pharmacological activities could be linked to the phytochemical constituents in the drug like alkaloids. Terpenoids. Steroids, saponins, tannins, etc. *Hyptis suaveolans (Linn.)Poit* being abundantly available and possessing similar pharmacological activities to *Tulasi* could very well substantiate the usage of *Bhustrina* in the shortage or absence of *Tulasi*.

The antimicrobial, antiviral activity of *Ocimum sanctum Linn.* is well known and has been used and practised in household as well as traditional clinicians for decades. In traditional medicine, due to the large availability and potent antipyretic activity, *Tulasi* (*Ocimum sanctum Linn.* (Linn.) Poit) has always been a choice of drug for fever and various infectious diseases. On the other hand, Hyptis suaveolans also could potentially compete with *Tulasi* on its therapeutic and pharmacological potential as an antiviral and antimicrobial drug due to the presence of chemical constituents like ursolic acid, pentacyclic triterpenoids which acts as strong protease inhibitors.

CONCLUSION

The present review is aimed to provide a broad understanding and in-depth assessment of the pharmacological and therapeutic potential of the drug *Bhustrina (Hyptis suaveolans (Linn.) Poit* in comparison to *Tulasi (Ocimum sanctum Linn. Linn.)* thereby further including the drug as an effective therapeutic agent against various metabolic and infective human diseases.

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