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REVIEW PAPER

A REVIEW ON THE PHARMACOLOGY AND PHYTOCHEMISTRY OF FOLKLORE MEDICINAL PLANT *HYPTIS SUAVEOLENS* (L.) POIT

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ABSTRACT

Hyptis suaveolens (L.) Poit. (Bush mint) belongs to the family Lamiaceae and commonly known as 'wilayati tulsi' in India. It is an invasive weed famous for its insecticidal property. Traditionally it is used for the treatment of respiratory tract infections, infection of uterus and skin diseases. Phytochemicals like steroids, alkaloids, phenolics, flavonoids, tannins, glycosides and essential oil isolated from the plant has medicinal and pharmaceutical importance. Extensive literature survey was made to identify the established research works on this magnificent plant and compiled it in a nutshell. The present review article is mainly focused on pharmacological and other important aspects of *H. suaveolens*.

Key-words: *Hyptis suaveolens*, essential oil, leaves, extract, phytochemicals

INTRODUCTION

Hyptis suaveolens (L.) Poit is a folklore medicinal plant used to heal wounds and treat gastrointestinal disorders, respiratory tract and uterus infections and skin diseases (Fig. 1). It is commonly found in dense clumps on roadsides, degraded moist and dry deciduous forest, waste lands and over-grazed pasture. It is a weedy alien species native to tropical America, now naturalized in the tropics and during its establishment, it upsets the recruitment pattern in the nearby occupied. The plant is commonly known as 'wilayati tulsi' because of its unique resemblance to 'tulsi leaves'. The other vernacular names are jungli tulsi, beejabandh (Hindi), ganga/gandha thulasi (Oriya), tokma, ganja tulsi, bilati tulsi, kusmai (Bengali) bhusri, dimbubha, gusumpuru (Bihari), konda thulasi, adavi tulasi (Telugu), bhustrena (Sanskrit), poothachedaiyan (Tamil) manjpatre (Kannada) naatta poochedi (Malayalam) and american mint, bush mint or the chan plant in English.

The plant is a sweet smelling woody herb with tetragonal hispid stem, leaves long petioled, pubescent, broadly elliptic-ovate, base oblique, truncate or acute, margin coarsely serrulate, apex acute, chartaceous. (Kumar *et al*., 2005) Flowers blue in short stalked axillary cymes, calyx ovoid, companulate and subequally 5 lobed, often accrescent. Corolla is bilabiate with lower deflexed and seccate lip and upper rounded. Stamens didynamous, anther cells confluent, glandular ovary 4 partite, gynobasic style with a shortly bifid stigma. Nut lets ovoid, smooth or rugulose (Gamble, 1921).

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Fig. 1: Habit of *Hyptis suaveolens* (L.) Poit.

TRADITIONAL USE

Hyptis is used for ethnobotanical applications in rural communities in Africa (Edeoga *et al.,* 2006). Traditionally the decoction of the roots is used as appetizer and the root is chewed with betel nuts as a stomachic; leaf sap with lemon juice added is taken in Sierra Leone for stomach ache and the leaf is applied around the head for head ache or topically to maturate boils (Dalzier, 1937). A leaf poultice is applied to cancers and tumours in America (Hartwell, 1969). The plant is used by various tribal communities of Maharashtra to cure various diseases like, parasitical cutaneous, diseases, infection of uterus, and as a sudorific in catarrhal condition. The plant is stimulant carminative, antispasmodic, antirheumatic and antisoporific baths. It is also used for headache, stomach-ache and snuff to stop bleeding of the nose (Nadkarni, 2005). It is a medicinal antidote to poison (Jain, 1991). In Guinea Bissau, periodic burning of leaves and flower (Palsson and Jaenson, 1999) and in Kenya, the overnight burning of leaves show repellence against mosquitoes (Seyoum *et al*., 2002). The tribal people use the plant to repel mosquitoes in Tamil Nadu (Singh *et al.,* 2005). In Nigeria the plant used for treating respiratory tract infections, colds, pain, fever, cramps and skin diseases. Seeds extract is a remedy for menorrhagia, leucorrhoea and temporary male sterility (Prashantkumar and Vidyasagar, 2006). Seeds soaked in water are used as soothing agent by Bheel tribe (Jain *et al,* 2010) (Ekka, 2011). In the Songkhla province, the whole plant decoction is used to cure fever and fatigue and the seeds are used to cure constipation and as antidiarrhoeal (Neamsuvan *et al.,* 2012). Mal Paharia tribes use the root as a blood purifier and leaves as an effective wound healer (Kumar and Abbas, 2012).

CHEMICAL CONSTITUENTS

Photochemical offers by plants have many high value chemicals useful as drugs, cosmetics, bio-polymers etc which are highly beneficial to human kind. Preliminary phytochemical screening of *Hyptis* shows the presence of many photochemical like steroids, alkaloids, phenolics, flavonoids, tannins, glycosides (Ijeh *et al*, 2007; Pachkore and Dhale, 2011[a]), juglones (Jelani and Prabhakar, 1991) and saponins. The antioxidant and anti-inflammatoy activity of flavonoids, ant-diarrhoeal and stomachic activity of tannins, analgesic, anti-pyretic and anti-coagulant properties of

glycosides were well established. The essential oil of aerial parts of *H. suaveolens* is predominated by β-caryophyllene (Fig. 2), 4-terpinenol, α-terpineol, α-terpinolene, α–phellandrene, α-copaene, α–thujene, α-humulene, α-bergamotene, β-pinene, β–pynene , β–elemene, γ–terpinene, γ–cadinene, δ-cadinene, linalool, fenchol, eugenol, camphene, sabinene, myrcene, 1, 8-cineole, aromadendrene, benzyl benzoate and a diterpene hydrocarbon II etc. Eucaliptol is the most abundant component in the oil in leaves, followed for γ–ellemene, beta-pynene, (+)-3-carene, trans-β-cariophyllene and germacrene. These essential oil can be applied in the aspergillosis treatment (Peerzada, 2007) dehydroabietinol (Azevedo *et al.,* 2001), limonene, bicyclogermacrene, β-phellandrene (Ziegler et al., 2002), monoterpenes, α-pinene and p-cymene (McNeil *et al.,* 2011).

Natural triterpenoid, characterized as 3β-hydroxylup-20(29)-en-27-oic acid (Triguna *et al.,* 1983), 3β-hydroxylup-12-en-28-oic acid and 3β-hydroxy lup- 12-en-28-oic acid, α- and β-amyrin (Misra *et al.,* 1983). The plant derived triterpenoids posseses various pharmacological properties. A large number of triterpenoids exhibits cytotoxicity against a variety of tumor cells as well as anticancer efficacy in preclinical animal models. A triterpenoid similar to betulin and betulinic acid was also identified (Sharma *et al*., 2010). Betulin and its derivatives however possess biological effects like anti-inflammatory, antiviral, anti-HIV, hepatoprotective. The oil of stems contains dierpene hydrocarbon II and palustrol (Tonzibo *et al.,* 2009), hyptadienic acid, suaveolic acid, suaveolol, methyl suaveolate, β-sitosterol, oleanolic acid, ursolic acid, rosamarinic acid (Manchand *et al.,* 1974). Suaveolol and methyl suaveolate are responsible for anti-inflammatory activity of the plant and hence used to treat dermatological diseases. Ursolic acid occur in the form of an aglycone of triterpene saponins inhibits the inflammatory enzymes cyclooxygenase and lipoxygenase. Rosmarinic acid, a polyphenol, possesess anti-oxidant property. (2E)-1-(2-hydroxy phenyl) pent-2-en-1-one (I) and 1-[(3-hydroxy-5, 5-dimethyl cyclohex-3-en-1yl) oxy] hexan-3-one (II) (Jayakumar *et al.,* 2005), 3β-hydroxylup-12-en-28-oic acid, 3β-hydroxylup-20(29)-en-27-oic acid (Satish *et al*., 2010) etc were isolated from various parts.

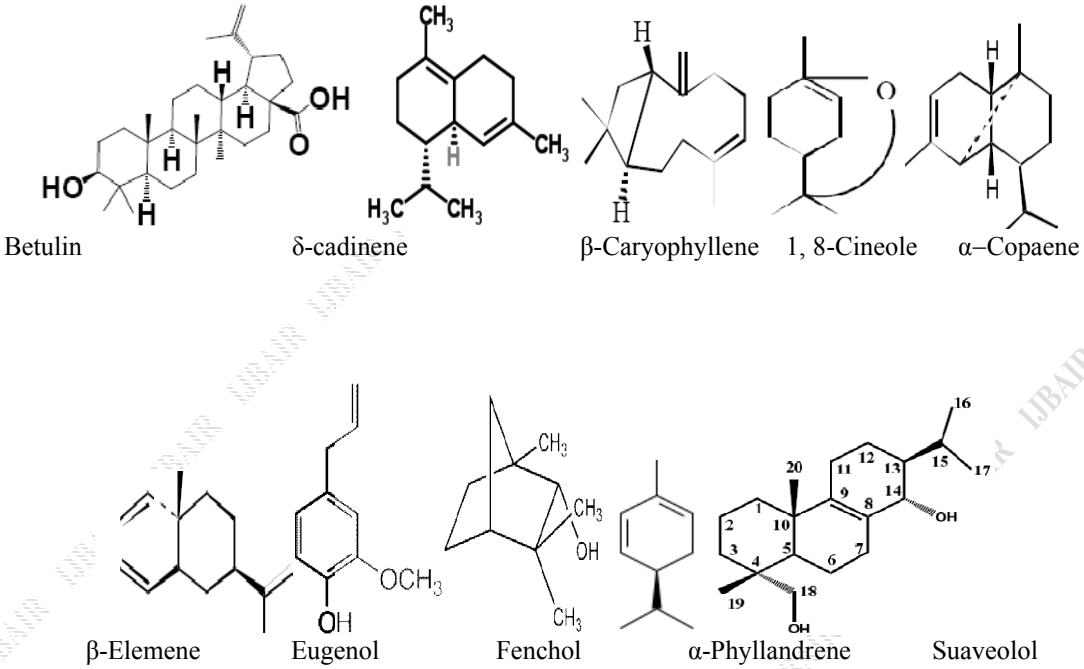

Fig. 2: Major photochemical found in *Hyptis suaveolens*

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PHARMACOLOGY

The plant has antiinflammatory, antinociceptive (Santos *et al.,* 2007), antiplasmoidal (Chukwujekwu *et al.,* 2005), antirheumatic, anticonvulsant (Akah and Nwambie, 1993), antiulcerogenic, carminative and lactagogue properties. It is used in catarrhal and uterine affections, parasitical cutaneous diseases, epistaxis etc (Khare, 2007). The plant is also used in nausea and infection of the gall bladder (Ahmed *et al.,* 1994). It can reduce calcium oxalate crystallization (Kumkum and Ranjana, 2012), which is comparable to that of proprietary drugs for dissolving kidney stones. The plant cures skin diseases and bronchial disorders (Koche *et al.,* 2010). Natural HIV-integrase inhibitor (Chatterjee and Pakrashi, 1997) and trypsin inhibitor (Aguirre *et al.,* 2004) were also isolated from this plant.

Antibacterial Activity: Methanolic leaf extract is active against *X. campestri* and is more effective than Kanamycin and Neomycin (De Britto and Gracelin, 2011). It shows inhibitory action on *S. aureus*, *E. coli* and *P. aeruginosa*. The volatile oil is toxic to *human* pathogenic bacteria (Iwu *et al.,* 1990), *B. cereus* (Asekun *et al.,* 1999), *Serratia marcescens* and *K. pneumoneae* (Pachkore *et al.,* 2011[b]).

Antidiabetic Activity: The methanol extract of leaves posses anti-diabetic activity in alloxan-induced diabetic rats. The presence of alkaloids, carbohydrates, flavonoids, tannins, steroids and/or terpenes in the leaves either as single constituents or in combination may be responsible for the anti-diabetic activity (Danmalam *et al.,* 2009).

Antifungal Activity: The essential oil extracted from the leaves has antifungal and antibacterial properties (Singh *et al.,* 1992) (Pandey *et al.,* 1982) (Nantitanon *et al.,* 2007). These are active against *S. cerevisiae*, *Mucor* sp. and *F. moniliforme* (Malele *et al*., 2003) and *F. oxysporum* (Tripathi *et al.,* 2009). Anti-aspergillus property against *A. fumigates*, *A. parasiticus* and *A. flavus* (Moreira *et al*., 2010) is well established. The plant shows activity against *Rhizoctonia solani*, *Sclerotium rolfsii* and *Sclerotinia sclerotiorum* and the oil in combination with *Trichoderma harzianum* controlled wilt and rot diseases by *S. sclerotiorum* (Singh and Handique, 1999). Growth inhibition also noticed in *A. niger*, *C. albicans*, *Cryptococcus* and *Fursarium* species in some instances the inhibition exceeded Griseofulvin (Mbatcbou *et al.,* 2010). The aqueous and ethanol extracts show inhibition of *C. albicans, Collectrotrichum capsici, F. oxysporum F. sp. Lycopersici* (Pachkore *et al.,* 2011).

Anti-Inflammatory Activity: *H. suaveolens* contains tannins which are used as antiinflammatory agents and also used topically for treatment of burns. Suaveolol and methyl suaveolate inhibits of croton oil-induced dermatitis of the mouse ear due to topical anti-inflammatory activity which is only two to three times lower than that of the reference drug Indomethacin (Grassi *et al.,* 2006).
Anti-Oxidant Activity: The healing properties exhibited by the ethanolic extract(Shirwaikar *et al.,* 2003) and the protective properties of free soluble polyphenols (Oboh, 2008) on Fe (II) induced lipid peroxidation in isolated Rat's brain are with a supportive role of antioxidant enzymes. It is identified that the antioxidant activity is due to the presence of flavonoids (Gavani and Paarakh, 2008).

Anti-Tumor Activity: The plant is also known for its anti-tumor and anti-cancer activities. The leaf is a potent anticancer agent in traditional medicine (Kingston *et al.,* 1979). Recently 1, 3-Propanediamine N (3- Aminopropyl)-N-Methyl isolated from *Hyptis suaveolens* has proved its anticancer potentials in Ehrlich Ascites Carcionoma Cell Line (Gurunagarajan and Pemaiah, 2011).

Gastro Protective Activity: Suaveolol obtained from ethanolic and aqueous extracts have gastro protective activity (Prabhat *et al*., 2009) (Vera-Arzave *et al*., 2012).

Hepatoprotective Activity: The leaf aqueous extract protects liver tissues against oxidative damages and acetaminophen induced toxicity (Babalola *et al*., 2011).

Toxicity: The extract of leaves exhibits low acute toxicity (Santos *et al*., 2007). The effect of water extract in Wistar rats reveals the trivial effect of the extract at given doses in rats (Attawish *et al.,* 2005).

Wound Healing Activity: Ethanolic, petroleum ether, alcoholic and chloroform water extract of leaves showed wound healing activity (Shenoy *et al.,* 2009). The activity may be due to free radical scavenging action of the plant and enhancing level of antioxidant enzymes in granuloma tissue (Shirwaikar *et al*., 2003).

Insecticidal and Larvicidal Activity: The phytochemicals from *H. suaveolens* can act as larvicide, insect growth regulators, and repellent and ovipositor attractant. Bush mint produce a very strong aromatic mint/thyme-like smell when the leaves are crushed lead to use of the plant as a powerful insect repellent (Oparaeke *et al.,* 2002) and the fumes of dried leaves are used to repel mosquitoes and control insect pests of stored grains(Alok *et al*., 2010; Okigbo *et al.,* 2010). It is active against cowpea weevil, *Callosobruchus maculates* (Jayakumar and Ganesh, 2012) and cow pea borer, *Maruca testulalis*. The aqueous extract with a lower dose of insecticides can control cotton bollworms and is active against stem borer *Sesamia calamistis* (Adda *et al*., 2011). Hyptis extracts shows mortality against *Sitophilus zeamais* and *Callosobruchus maculates* (Iloba and Ekrakene, 2006). It can also control insects and nematodes (Oyedunmade, 1998). Dehydroabietinol revealed an *in vitro* antiplasmodial effect against *Plasmodium falciparum* (Ziegler *et al.*, 2002). Essential oil is as effective for personal protection against mosquito bites (Abagli and Alavo, 2011). The hexane leaf extracts showed larvicidal, and ovicidal activity against *A. aegypti, An. stephensi* and *C. quinquefasciatu* (Arivoli and Tennyson, 2011; Raja *et al.,* 2012). The ethyl acetate extracts acts against *Helicoverpa armigera* and *Spodoptera litura* (Ivoke *et al.*, 2009; Musa *et a*l., 2009). The aqueous and ethanolic extract show reduced the viability in *Anopheles gambiae* (Kala *et al*., 2006). Its application is required to control *Trogoderma granarium* and the methanol extract of seed can be a substitute to synthetic insecticides (Bernard *et al*., 2001). The ticks of *Hyalomma* sp., *Rhipicephalus* sp. and *Haemophysalis* sp. were found to be highly susceptible to the steam distillate of *Hyptis* (Kapoor, 2011).

Other Important Activities: The plant is reported to be a potent antihelminthic and antimalaric (Chukwujekwu *et al.,* 2005). An anti-phospholipase A2 activity was observed for the aqueous extract (Berbard et al., 2001). The essential oil from leaves has antifertility properties (Peerzada, 2007; Shirwaikar *et al*., 2003). The leaf residues can be used as potent bio-herbicide to control the spread of *Parthenium* (Kapoor, 2011).

CONCLUSION:

Though *Hyptis suaveolens* is an invasive obnoxious weed, the literature survey reveals the therapeutic efficiency of the plant. The phytochemicals isolated from this medicinal has been effectively using in many health problems since a long time. The present review work provides a wide area of interest for planning and conducting research on this wonderful plant to develop novel drug molecules for the future.

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