Tropical Journal of Pharmaceutical Research July 2020; 19 (7): 1541-1550
ISSN: 1596-5996 (print); 1596-9827 (electronic)

Available online at http://www.tjpr.org
http://dx.doi.org/10.4314/tjpr.v19i7.29

Review Article

An ethnopharmacological review of *Hyptis suaveolens* (L.) Poit

Rong Li, Gengqiu Tang, Xile Liu, Junni Li, Dong Wang, Shengguo Ji*
School of Chinese Traditional Medicine, Guangdong Pharmaceutical University, Guangdong 510006, PR China

For correspondence:* ***Email:* *shengguo_ji@163.com;* ***Tel:*** *+86-18027342788*

Sent for review: 11 November 2019 *Revised accepted: 22 June 2020*

Abstract

This review aimed to provide a comprehensive overview of ethnobotanical uses, chemical constituents, posology, and toxicology of Hyptis suaveolens, and to address the significant medicinal benefits in order to promote its application. An extensive and systematic review of the literature was undertaken and all relevant abstracts and full-text articles analyzed and included in the review. A wide range of traditional uses are cited in the literature, ranging from uses for malaria, constipation, stomach problems, renal inflammation to external uses in repelling insects and treating injuries such as lacerations and burn-related damage to skin and tissues. To date, pharmacological studies have demonstrated the significant activities of this plant that support uses such as antimicrobial, antidiabetic, antiulcer, and anti-inflammatory. Numerous important phytochemicals, including 6 triterpenes, 8 diterpenes and 1 flavonoid have been isolated, identified and reported. The extracts and phytochemicals isolated from the plants show considerable potential for medicinal exploitation and utilization, including antimitotic, anti-proliferative, cytotoxic, antioxidant, anti-inflammatory, antibacterial, antifungal, antiviral, anti-secretory, hepatoprotective, insecticidal, and acaricidal activities. As a medicinal plant, H. suaveolens is endowed with immense exploitation and utilization value and is widely used worldwide Therefore, further studies to fully elucidate its medicinal potential are warranted.

Keywords: *Hyptis suaveolens (L.) Poit, Ulcer Antimicrobial Inflammation, Diterpenes, Traditional medicine, Ethnopharmacology, Lamiaceae*

Tropical Journal of Pharmaceutical Research is indexed by Science Citation Index (SciSearch), Scopus, International Pharmaceutical Abstract, Chemical Abstracts, Embase, Index Copernicus, EBSCO, African Index Medicus, JournalSeek, Journal Citation Reports/Science Edition, Directory of Open Access Journals (DOAJ), African Journal Online, Bioline International, Open-J-Gate and Pharmacy Abstracts

INTRODUCTION

Species of the family Lamiaceae, which are largely herbaceous and of economic importance, are found mostly in tropical, subtropical, and temperate parts of the world. *Hyptis suaveolens* (L.) Poit is belonging to the genus *Hyptis* and family Lamiaceae that includes 775 species worldwide, which are primarily found in South America. Plants of the *Hyptis* genus have been highlighted for numerous medicinal properties such as tumorigenic, antifertility, antimicrobial, mycotoxic, and phytotoxic activities [1]. Among these plants, *Hyptis suaveolens* (L.) Poit is an important traditional medicinal plant that was originally native to tropical America and is currently considered as a weed worldwide.

H. suaveolens (Fig. 1) is a fast-growing perennial and aromatic herb that is 0.4–2 m high with a

quadrate stem that bears hair. The leaves are either ovate or obovate, generally measuring 3–5 cm long and 2–4 cm wide with serrulate margins and a long stalk while its petioles are up to 3 cm long. The plant starts flowering early at an age of 2–3 months and produces copious blue flowers in small cymes along branches that end with reduced leaves. The flowers are pollinated by numerous pollinators leading to enormous seed production [2-3].

H. suaveolens is commonly distributed in dense clumps along roadsides, in over-grazed pastures, and around stockyards throughout the tropics and subtropics, but is normally restricted to places where the soils have been profoundly disturbed. The plant is characterized by a strong minty smell when crushed. Most parts of this plant are used in medicine formulations for treating numerous ailments such as respiratory and gastrointestinal infections, indigestion, colic, stomachache, colds, fever, burns, wounds, cramps and various skin complaints and it is used as an antirheumatic and antisuporific bath [4-6].

The plant has different names in various countries (Table 1, Table 2, and Table 3). For example, it is locally known as *Bushmint, alfazema-brava, bamburral*, or *tapera velha* in Brazil [7]; chichinguaste in El Salvador [8]; Chanor Picnut in Nicaragua [9]; Chia or Chan in Mexico [10]; Shan Xiang or maolaohu in China; gros, baumes, or hiptis à odeur in French; Indischer, Andorn, Wohlriechender Andorn, or Buschminze in German; bilati tulsi or ganga tulsi in Hindi; lampesan, jukut bau, or mangkamang in Indonesian; nioi-niga-kusa in Japanese; malbar, hutan, or pokok kemangi in Malaysian; chío gorda or chía grande in Mexico; amotan, suob-kabayo, or loko-loko in Filipino; bamburral or mentrasto-grande in Portuguese; issop in Russian; oregano, or cimarron in Spannish; and kara or maeng lak kha in Thai [11].

H. suaveolens also has numerous synonyms, such as *Gnoteris cordata* Raf., *Hyptis congesta* Leonard., *Hyptis graveolens* Schrank, *Marrubium indicum* Blanco, *Schaueria graveolens* (Blume) Hassk. Or *Schaueria suaveolens* (L.) Hassk [12].Over the past years, few studies have focused on reviewing *H. suaveolens* in the literature and we did not find any comprehensive reviews of *H. suaveolens*, although its growing regions, phytochemistry, toxicity, and food and medicinal uses have been summarized to a certain extent [2,3,10,12]. To acquire provide additional knowledge on the considerable applicability and usefulness of this plant, here, we present a review of *H. suaveolens* that include its characteristics, uses, chemical constituents, posology, phytochemistry and toxicology to facilitate the development and utilization of *H. suaveolens.*

Figure 1: *Hyptis suaveolens (L.) Poit* (Lamiaceae)

METHODS

This review involved literature search on *H. suaveolens* (L.) Poit (Lamiaceae) using databases such as PubMed (http://www.ncbi.nlm.nih.gov/pubmed), ScienceDirect (https://www.sciencedirect.com), and Web of Science (http://apps.webofknowledge.com) as well as search engines such as Baidu Scholar (http://xueshu.baidu.com) and Google Scholar (http://scholar.google.com). In confirming relevant entries, we considered publications up to the end of March 2020. Searches undertaken were found to be written in English, Portuguese, or Chinese.

FINDINGS

Weed characteristics

H. suaveolens, considered to be a weed worldwide, is currently ranked according to the importance of its use in different areas (Table 4). For instance, it is considered a serious weed in Brazil, a principal weed in Peru and Tanzania, but is a common weed in Australia, India, Micronesia, Philippines, Taiwan, and Thailand. This species is found in Cambodia, Ceylon (Sri Lanka), Congo-Kinshasa, Colombia, Costa Rica, Benin, Fiji, Ghana, Indonesia, Jamaica, Lebanon, Malaysia, Mauritius, Melanesia, Mexico, Netherlands, New guinea, Nicaragua, Panama, South Africa, Senegal, the US, Venezuela, and Vietnam, where it is also considered a weed, but of unknown ranked status. In China, the species is known to exist among the flora of the country,

but confirmatory evidence of its weed status is needed [13].

Distribution

H. suaveolens is found across more than 50 countries in over the seven continents (Figure 2), including South American areas such as Brazil, Polynesia, Ecuador, French Guiana, Peru, Colombia, and Venezuela; Central American regions such as Belize, El Salvador, the Caribbean, Guatemala, Costa Rica, and Nicaragua; Latin American countries such as Honduras; North American areas such as Puerto Rico, Jamaica, Mexico, Panama, Trinidad and Tobago, Curacao, and the US; African countries such as Tanzania, Congo, Benin, Ghana, South Africa, Mauritius, Senegal, Nigeria, Burkina Faso, Guinea-Bissau, and Kenya.

In addition, it is also found in Oceanian countries such as Australia and New Guinea; Asian countries such as India, Bangladesh, Cambodia, Thailand, Indonesia, Lebanon, Malaysia, Vietnam, and China; Western Pacific countries including Micronesia and the Philippines; areas around the Indian Ocean such as Ceylon; Pacific regions such as Melanesia and Fiji; and European areas including the Netherlands. The literature survey revealed that only 22 developing countries among those listed here recorded the medicinal uses of this plant. *H. suaveolens* is more commonly used as a folkloric herbal medicine in developing countries [2].

Traditional medicinal uses

The different traditional medicinal uses of various parts of *H. suaveolens* in over 23 countries are summarized in Table 1, Table 2 and Table 3, where they are arranged by frequency of the same use in different countries. Five of these countries are located in Central America, four in Asia (Bangladesh, China, India, and Thailand), four in Africa (Tanzania, Nigeria, Burkina Faso, and Kenya) two in the Caribbean (Jamaica and Curaçao), and one in South America (Brazil). A wide range of traditional medicinal uses of this plant are reported in the literature. These applications range from *in vivo* use for conditions affecting the respiratory system, gastrointestinal tract, and gynecological system to *in vitro* conditions affecting the skin [53]. This plant appears to be most commonly reported to be used in the treatment of fever and headache (reported in fourteen countries), as an insect repellent, for stomach disorders, skin conditions, injuries (five countries each), weakness (two countries), abnormal leucorrhea, renal disorders, dysentery, and malaria (three countries each). In addition, the plant is also less frequently reported to be used for male disorders and menorrhagia (two countries each).

Posology

For headaches and colds, a decoction is prepared from 6–12 g of *H. suaveolens* for oral administration with a decoction of the fresh plant used to wash the body. In Bangladesh, 2 g of the seeds of *H. suaveolens* are soaked in water with mishri (crystalline sugar) for a whole day and then consumed for treating underweight [26]. In Bidar District of Karnataka in India, a spoonful (10 g) of the seed extract is administered orally once a day for 3 days as a remedy for leucorrhoea and temporary male infertility. Documentation of traditional knowledge of medicinal plants used in Bidar District and Karnataka reports that in Seshachalam Biosphere Reserve Forest of Chittoor District and Andhra Pradesh India, 4–7 g of the leaf powder is rolled in beedi leaves, which is then smoked to relieve colds and nasal congestion [36]. With an iron-deficient diet and high incidences of blood-sucking helminths, people in Bastimentos and Panama struggle with iron deficiency anemia. Consequently, a black drink prepared from *H. suaveolens* is the ethnopharmacological treatment for these pathologies, including iron deficiency anemia that is widely used in Bastimentos and unique to this community [54].

Phytochemistry

Research on the phytochemistry of *H. suaveolens* are has revealed that extracts of its different plant contain alkaloids, flavonoids, terpenoids, and tannins [55,56]. The saponin content of the leaves and stems is 6.10% ± 0.42% and 10.50% ± 0.79 %, respectively, while saponins have not been found in the roots. The contents of alkaloids, flavonoids, and tannins in the leaves are 2.80 ± 0.28, 1.90 ± 0.14, and 5.50 ± 0.074 %, respectively. Compared to the stem, the contents of alkaloids, flavonoids, and tannins are 1.60 ± 0.00, 0.30 ± 0.14, and 0.23 ± 0.07 %.

Chemical constituents

Over the past years, the chemical constituents of *H. suaveolens* have been investigated widely in different the countries, and numerous new compounds have been isolated from this plant and their structures identified. In this paper, the dominant compounds isolated from different parts of *H. suaveolens* collected from various regions are summarized in Table 5 and Table 6. The structures of these compounds are mostly terpenoids including sesquiterpenes, diterpenes,

triterpenes, and β-sitosterol. Most studies of the chemical constituents reported that they were mainly accumulated in the essential oil of the plant, but little attention has been focused on other extracts of *H. suaveolens.*

Toxicity

Extracts of *H. suaveolens* have shown effective insecticidal activity because of their toxicity to plant pests. The explanation for this biomechanism may be that the volatile oil of the extracts, which are characterized by a strong odor, can reduce the appetite of insects for the plants. The toxic effects of *H. suaveolens* are summarized in Table 7.

Figure 2: The distribution of *Hyptis suaveolens* in the world

Table 1: Ethnomedical uses of *Hyptis suaveolens* (L.) Poit *(contd.)*

Country	Ethnomedical use	Plant part(s)	Preparation	Reference
Bangladesh	Acidity, flatulence, gastric troubles	Seed	Sherbet[a] (int[b])	14
	Boils	Seed	Maceration (applied around boils)	15
	Boils	Root	Paste (ext[c])	16
	Cancer, constipation, liver diseases	Seed, leaf	Not stated	17
	Constipation	Leaf, bark	Not stated	18
	Cooling agent, kidney disease, urinary tract dysuria, infections, laxative.	Seed	Sherbet[a] (int[b])	19
	Gonorrhea	Seed	Along with other herbs	20
	Headache	Whole plant	Crush (applied topically to the forehead)	21
	Insect repellent	Whole plant	Dried and powdered whole plant is spread	21
	Itching	Root	Extract	16
	Leucorrhea in women, low sperm density in men.	Seed	Sherbet[a] (int[b])	22
	Loss of libido, to keep body cool	Seed	Sherbet[a] (int[b])	15
	Malaria	Whole plant	Crush (int[b])	21
	Physical weakness, sense of hotness in head	Seed	Powdered seeds are mixed with sugar	23
	Stomach ache in children	Stem	Juice obtained from crushed stems is mixed with sugar	24
	Stomach problems	Seed	Raw (int[b])	25
	To clear objects from eyes	Seed	Application of fruit to eyes	25
	Underweight	Seed	Sherbet[a] (int[b])	26
Brazil	Diarrhea, digestive system, headache	Whole plant	Tea, syrup and infusion	27
	Inflammation of the uterus and ovaries	Bark	Tea	28
	Inflammatory, ulcer	Whole plant	Tea, bath	29
Burkina Faso	Cold, cough	Leaf	Not stated	30
	Insect repellent, itchy skin	Leaf, stem	Not stated	31
China	Athlete's foot	Leaf	Pound (ext[c])	32
	Cold	Whole plant	Decoction (int[b])	33
	Diabetes, diarrhoea	Seed	Boiled (int[b])	32
	Eczema, dermatitis	Whole plant	Decoction (wash affected area)	32
	Eliminate toxin in the body	Leaf (fresh) or wholeplant	Decoction	33
	Infertility	Root	Stew with chicken (int[b])	33
	Lobar seeper, pleurisy	Whole plant	Stew with pig lung or lean (int[b])	33
	Lymphoma	Root (fresh)	Stew with green-shell duck eggs (int[b])	32, 33
	Snakebite	Leaf (fresh)	Pound (ext[c])	32, 33

Table 2: Ethnomedical uses of *Hyptis suaveolens* (L.) Poit *(contd.)*

Country	Ethnomedical use	Plant part(s)	Preparation	Reference
India	Blood purifier	Root	Not stated	34
	Boil, cuts, wounds	Leaf	Not stated	34
	Chest pains, cough, wound healing	Whole plant	Not stated	35
	Cold, fever and nasal congestion	Leaf	Beedi (inhalation)	36
	Cough	Leaf	Eaten raw	37
	Menorrhagia, leucorrhoea, temporary male sterility	Seed	Extract (intb)	38
	Skin disease	Leaf	Not stated	35
	Smoothing agent	Seed	Sherbet[a]	39
	Wounds	Leaf	Juice (ext[c])	40
Nigeria	Boils	Leaf	Juice (ext[c])	41
	Control the vector, mosquito	Whole plant	Smoke (smoking)	42
	Facilitate, childbirth, repel malaria-causing insects	Leaf (fresh)	Extract (int[b])	43
	Headache	Whole plant	Tied around the head until the ache stops	42
	Headache, mosquito repellant	Leaf (fresh)	Juice	44
	Malaria	Leaf	Not stated	45
	Mosquito repellent	Whole plant (fresh)	Raw	42
Philippines	A stimulant if employed in rheumatism	Root	Decoction	46
	Antirheumatic and antisuporific	Leaf and top	Baths	47
	Antispasmodic	Leaf and top	Not stated (int[b])	47
	Appetizer	Root	Decoction	46
Senegal	Expectorant	Stem with flower and seed	Infusion (int[b])	48
	Headache and cold	Flower	Introduced into the nostrils	48
	Migraine	Powdered plant part	Not stated	48
	Tonic	Stem with flower and seed	Decoction (int[b])	48
Tanzania	Abdominal pains and general body weakness	Leaf	Vapours from boiling leave(inhalation)	49
	Epileptic cases, psychosomatic	Leaf, stem	Ashes (the leaves stems are burned and ashes applied over scarifications on the body)	49
	Leukorrhoea	Root	Decoction (int[b])	49
Thailand	Antidiarrhoeal	Seed	Not stated	
	Constipation	Seed	Dessert (int[b])	50
	Fever, fatigue	Whole plant	Decoction	
Trinidad	Colds, constipation, fever, flu, malaria, fever, menorrhagia, yellow fever	Leaf	Tea	51
	Common cold & cough	Leaf	Infusion or crush and inhaled	52

Table 3: Ethnomedical uses of *Hyptis suaveolens* (L.) Poit *(contd.)*

Country	Ethnomedical use	Plant part(s)	Preparation	Reference
Trinidad	Fever	Leaf	Infusion or crush and inhaled	52
	Flu	Leaf	Bath	51
	Cooling/cleanser	Leaf	Infusion or crush and inhaled	52

[a] sherbet = Seeds are soaked in water in which mishri (crystalline sugar) has been dissolved and taken as a drink; [b]int = internal use; [c]ext = external use

Table 4: Posology of *Hyptis suaveolens* (L.) Poit.

Ailment	Preparation and usage	Dosage	Region
Headaches and cold	Decoction is drunk with decoction of fresh plant washing body	6 - 12g	
Underweight	Seeds are soaked in water with mishri (crystalline sugar) for awhole day and then taken	2 g	Bangladesh
Leucorrhoea and temporary male sterility	Seeds extract is taken internally once a day for 3 days	10 g	Karnataka of India
Cold and nasal congestion	Leaf powder is kept in beedi leaves and being smoked	4-7 g	Chittoor District and Andhra Pradesh India
Iron deficiency anemia	Black Drink	Not stated	Bastimentos and Panama

Table 5: Chemical constituents isolated from *Hyptis suaveolens* (L.) Poit *(contd.)*

Dominant compounds	Isolated part	Plant source	Reference
L-Fuco-4-O-methyl-D-glucurono-D-xylan	Seed-coat mucilage	Not stated	57
1, 8-Cineole, -caryophyllene, -Copaene, -Phellandrene, -elemene, eugenol	Essential oil	Darwin, Australia	58
sabinene, trans-a-bergamotene, β-caryophyllene, terpinen-4-ol, β-pinene	Essential oil	Nigeria	59
sabinene, β-caryophyllene, rrans-alpha-bergamotene	Essential oil	Mali	60
Sabinene, limonene, biclyclogermacrene, β-phellandrene, 1,8-cineole	Essential oil	Brazilian Cerrado	61
Spathulenol, 1,8-cineole , (E)-caryophyllene	Essential oil	Brazilian Cerrado	62
β-caryophyllene, β-elemene, trans-α-bergamotene, spathulenol, bicyclogermacrene	Essential oil	Tanzania	63
Sabinene, limonene, 1,8-cineole, (E)-caryophyllene, spathulenol	Essential oil	Brazil	6
α-pinene, sabinene, p-cymene, terpinen-4-ol, terpinolene, 1,8-cineole, β-pinene, α-terpinene, β-caryophyllene, trans-α-bergamotene	Essential oil	Nigeria	64
Fenchone-fenchol-chemotype, 1,8-cineole, α -terpinolene, sabinene	Essential oil	El Salvador	65
sabinene, β -caryophyllene, bergamotol	Essential oil	Cameroon	66
abietane-type diterpenoid endoperoxide, 13α- epi -dioxiabiet-8(14)-en-18-ol	Leaves	southeastern Nigeria	67
terpenes spathulenol, globulol, dehydroabietol, a-cadinol, beta-phellandrene	Essential oil	Brazil	68
Sabinene, β-caryophyllene	Essential oil	Togo	69
5-caranol, α-humulene, allo-aromadendrene, Ermephilene, cis-sabinol, camphor	Essential oil	South India	70
sabinene, 1,8-cineole, γ-terpinene, fenchone, fenchol, the sesquiterpene β-caryophyllene	Essential oil	El Salvador	71
β-caryophyllene, α-phellandrene, caryophyllene oxide	Essential oil	Nigeria	72
β-caryophyllene, trans-α-bergamotene, caryophyllene oxide, 6-hydroxycarvotanacetone, bicyclogermacrene, (Z)-trans-α-bergamotol, terpinen-4-ol.	Essential oil	Benin	73
Eucaliptoll, gama-ellemene, beta-pynene, (+)- 3-carene, trans-beta-cariophyllene, germacrene	Essential oil	Brazil	74

Table 6: Chemical constituents isolated from *Hyptis suaveolens* (L.) Poit *(contd.)*

Dominant compounds	Isolated part	Plant source	Reference
Monoterpene hydrocarbons, sesquiterpene hydrocarbons, oxygenated monoterpenes, oxygenated sesquiterpenes	Essential oil	Pisa, Italy	75
Sabinene, β-caryophyllene, terpinolene, β-pinene, limonene, 4-terpineol	Essential oil	Pisa, Italy	76
Isosuaveolic acid, 8,9-epoxysuaveolic acid, 14-O-methylsuaveolic acid	Whole plant	Nakhon Ratchasima, Thailand	77
A-phellandrene, limonene, 1,8-cineole, fenchone, E-caryophyllene, germacrene D	Leaves and flowers	Arauca, Colombia	78
Suaveolic acid	Whole plant	Bangladesh	79
11S globulin (Hs11S)	Seed	Colima City, Mexico	80
1,8-cineole, E-caryophyllene, sabinene, terpinolene, bicyclogermacrene	Essential oil	Uttarakhand, India	81
Galactoglucan, galactoglucomannan	Seed mucilage	North of Thailand	82
Caffeic acid, rutin, quercetin, Citric acid, ferulic acid, gluconic acid	Aqueous extract	Ghana	83
3-O-beta-D-glucopyranoside, apigenin, sorbifolin, quercetin, kaempferol, genkwanin, rosmarinic acid, methyl rosmarinate, podophyllotoxin, picropodophyllotoxin	Whole plant	China	84

Table 7: Toxic effect of *Hyptis suaveolens* (L.) Poit.

Toxic part	Toxicity	Value	Application	References
Aqueous leaf extract	Inhibit root growth of *Allium cepa*	EC_{50} value of 1.92%	As herbal insecticides/ pesticides	85
Ethanolic extract	Toxic effect on larvae of *Aedesaegypti*	LD_{10} value of 0.01 ppm, LD_{50} value of 0.60ppm, LD_{90} value of 1.45ppm		86
Essential oil	Toxic and repellent activity against *Sitophilus granarius* (L.)	At the lowest dose (2×10^{-4} µL oil per cm^2)		75
Essential oil	Toxic effects on *Drosophilamelanogaster* and *Artermiasalina*	LC_{50} value of 15.5 and 49.72 µg/mL, respectively		87

CONCLUDING REMARKS

H. suaveolens is an important medicinal plant used in various indigenous herbal medicines for treating numerous diseases, as is clearly shown in the above-mentioned summary of its ethnobotanical, chemical, posology, and toxicological properties. Although there are numerous reports on the chemical composition and pharmacological properties of *H. suaveolens*, most studies were conducted on its essential oils. Therefore, more new compounds from other parts of this plant still need to be isolated and identified because the specific constituents mediating the pharmacological activities have not been identified. Safety assessments of *H. suaveolens* suggest that it has acute or chronic toxicity against grain pests, which suggests that it could be used as a herbal insecticide or pesticide. In addition, to further explore and exploit the therapeutic potential of *H suaveolens,* quality control protocols are urgently needed to standardize this plant.

DECLARATIONS

Acknowledgement

The authors are very thankful for Guangdong Pharmaceutical University for providing the necessary facilities and encouragement to carry out this work successfully.

Conflict of interest

No conflict of interest is associated with this work.

Contribution of authors

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors.

REFERENCES

1. *Mcneil M, Facey P, Porter R. Essential oils from the Hyptis genus—a review (1909–2009). Nat Prod Commun 2011; 6: 1775-1796.*
2. *Sharma PP, Roy RK, Anurag, Dinesh G, Sharma VK. Hyptis suaveolens (L.) poit: A phyto-pharmacological review. Int J Chem Pharm Sci 2013; 4: 1-11.*
3. *Priya MD. A review on the pharmacology and phytochemistry of folklore medicinal plant Hyptis suaveolens (L.) Poit. Int. J. Basic, Appl. Innovative Res 2015; 4: 108 - 117.*
4. *Mahesh S, Chatterjee A, Pakrashi SC. The Treatise on Indian Medicinal Plants, Vol 5, (PID, New Delhi), 2001, 1.*
5. *Asekun OT, Ekundayo O, Adeniyi BA, Antimicrobial activity of the essential oil of Hyptis suaveolens leaves. Fitoterapia 1999; 70: 440-442.*
6. *Oliveira MJ, Campos IFP, Oliveira CBA, Santos MR, Souza PS, Santos SC, Seraphin JC, Ferri PH. Influence of growth phase on the essential oil composition of Hyptis suaveolens. Biochem System Ecol 2005; 33: 275-285.*
7. *Jesus N, Falcão H, Lima G, Caldas Filho M, Sales I, Gomes IF, Santos SG, Tavares JF, Barbosa-Filho JM, Batista LM. Hyptis suaveolens (L.) Poit (Lamiaceae), a medicinal plant protects the stomach against several gastric ulcer models. J Ethnopharmacol 2013; 150: 982-988.*
8. *Grassi P, Reyes TSU, Sosa S, Tubaro A, Hofer O, Zitterl-Eglseer K. Anti-inflammatory activity of two diterpenes of*

Hyptis suaveolens from El Salvador. Z Naturforsch C 2006; 61: 165-170.

9. *Barrett B, Kiefer D. Ethnomedical, biological and clinical support for medicinal plant use on Nicaragua's Atlantic coast, J Herbs Spices Med Plants 1997; 4: 77-108.*
10. *Solomon RA, Vergara SI. Hyptis suaveolens-Aprized weed. J. Nat. Con 1997; 9: 123-127.*
11. *Seidemann J. World spice plants, (Springer), 2005.*
12. *Ngozi LU, Ugochukwu N, Ifeoma PU, Charity EA, Chinyelu IE. The efficacy of hyptis suaveolens: a review of its nutritional and medicinal applications. Eur J Med Plants 2014; 4: 661-674.*
13. *Holm L, Pancho JV, Herberger JP, Plucknett DL. A geographical atlas of world weeds. Brittonia 1980; 32: 127-127.*
14. *Khan MA, Hasan MN, Jahan N, Das PR, Islam MT. Ethnomedicinal wisdom and famine food plants of the Hajong community of Baromari village in Netrakona district of Bangladesh. Am Eur J Sustain Agric 2012; 387-398.*
15. *ahmatullah M, Hasan ME, Islam MA, Islam MT, Jahan FI, Seraj S, Chowdhury AR, Jamal R, Islam MS, Miajee ZEU. A survey on medicinal plants used by the folk medicinal practitioners in three villages of Panchagarh and Thakurgaon district, Bangladesh. Am Eur J Sustain Agric 2010; 4: 291-301.*
16. *Rahman MA. Indigenous knowledge of herbal medicines in Bangladesh. 3. Treatement of skin diseases by tribal communities of the hill tracts districts. Bangladesh J Botany 2010; 39: 169-177.*
17. *Rahmatullah M, Mollik MAH, Khatun MA, Jahan R, Chowdhury AR. A survey on the use of medicinal plants by folk medicinal practitioners in five villages of Boalia sub-district, Rajshahi district, Bangladesh. Adv Nat Appl Sci 2010; 4: 39-44.*
18. *Rahmatullah M, Mollik AH, Paul AK, Jahan R, Khatun A, Seraj S, Chowdhury AR, Bashar A, Wahab R, Rahman T. A comparative analysis of medicinal plants used to treat gastrointestinal disorders in two sub-districts of Greater Khulna Division, Bangladesh Adv Nat Appl Sci 2010; 4: 22-29.*
19. *Hossan MS, Roy P, Seraj S, Mou SM, Monalisa MN, Jahan S, Khan S, Swarna A, Jahan R, Rahmatullah M. Ethnomedicinal knowledge among the Tongchongya tribal community of Roangchaari Upazila of Bandarban district, Bangladesh. Am Eur J Sustain Agric 2012; 6: 349-359.*
20. *Mia MM, Kadir MF, Hossan MS, Rahmatullah M. Medicinal plants of the Garo tribe inhabiting the Madhupur forest region of Bangladesh. Am Eur J Sustain Agric 2009; 3: 165-171.*
21. *Rahmatullah M, Mollik AH, Rahman S, Hasan N, Agarwala B, Jahan R. A medicinal plant study of the Santal tribe in Rangpur district, Bangladesh. J Altern Complem Med 2010; 16: 419-425.*
22. *Rahmatullah M, Das PR, Islam T, Ripa RJ, Hasan E. Medicinal plants and formulations of the Bongshi tribe of Bangladesh, Am Eur J Sustain Agric 2012; 6: 181-187.*
23. *Kabir MH, Hasan N, Rahman MM, Rahman MA, Khan JA, Hoque NT, Bhuiyan MR, Mou SM, Jahan R, Rahmatullah M. A survey of medicinal plants used by the Deb barma clan of the Tripura tribe of Moulvibazar district, Bangladesh. J Ethnobiol Ethnomed 2014; 10: 1.*
24. *Sarker MN, Mahin AA, Munira S, Akter S, Rahmatullah M. Ethnomedicinal plants of the Pankho community of Bilaichari Union in Rangamati district, Bangladesh. Am Eur J Sustain Agric 2013; 7: 114-120.*
25. *Shaheen EK, Syef A, Saha SS, Islam S, Al Hossain D. Medicinal plants used by the folk and tribal medicinal practitioners in two villages of Khakiachora and Khasia Palli in Sylhet district, Bangladesh. Adv. Nat. Appl. Sci 2011; 5: 100-111.*
26. *Rahmatullah M, Hasan A, Parvin W, Moniruzzaman M, Khatun A, Khatun Z, Jahan FI, Jahan R. Medicinal plants and formulations used by the Soren clan of the Santal tribe in Rajshahi district, Bangladesh for treatment of various ailments. Afr J Tradit Complement Altern Med 2012; 9: 350-359.*
27. *Gonçalves KG, Pasa MC. The ethnobotany and medicinal plants in Community Sucuri, Cuiabá, MT, Brazil, Interações (Campo Grande) 2015; 16: 245-256.*
28. *Pasa MC. Local knowledge and folk medicine: ethnobotany in Cuiabá, Mato Grosso, Brazil, Bol. Mus. Para. Emílio Goeldi. Cienc. Hum., Belém 2011; 6: 179-196.*
29. *Jesus NZTd, Lima JCdS, Silva RMd, Espinosa MM, Martins DTdO. Ethnobotanical survey of plants popularly used as anti-ulcer and anti-inflammatory in Pirizal, Nossa Senhora do Livramento, MT, Brazil. Rev Bras Farmacogn 2009; 19: 130-139.*
30. *Sourabié T, Some N, Bognonou O, Ouattara Y, Ouédraogo J. Ethnobotanical and ethnopharmacognostical survey on medicinal plants of Malon village and surrounding in the Cascades Region (Burkina Faso). Iosr J Pharm 2013; 3: 11-15.*
31. *Regina KMM, Adama H, Jeanne M, Odile N. Ethnobotany and Ethnopharmacognosy of Lamiaceae Species from Central Burkina Faso: Leucas martinicensis (Jacquin) R. Brown, Hoslundia opposita Vahl and Orthosiphon pallidus Royle Ex Benth. Am J Ethnomed 2015; 2: 219-232.*
32. *Gang Rong L. Taiwan Qing Cao Yao Dui Zheng Tu Dian: Book one, (Northwest International Culture Co, Taiwan), 2009.*
33. *Society TCMP, Illustration of Medicinal Plants in Taitung, the second series, (WENHSIN PRESS, Taitung), 2012.*
34. *Kumar K, Abbas SG, Ethnomedicinal composition depends on floristic composition: A case studied in Sal forests of Jharkhand. Int J Pharm Life Sci 2012; 1710-1719.*
35. *Samydurai P, Jagatheshkumar S, Aravinthan V, Thangapandian V. Survey of wild aromatic ethnomedicinal plants of Velliangiri Hills in the Southern Western Ghats of Tamil Nadu, India. Int J Med Arom Plants 2012; 2: 229-234.*

36. Ganesh P, Sudarsanam G. Ethnomedicinal Plants used by Yanadi Tribes in Seshachalam Biosphere Reserve Forest of Chittoor District, Andhra Pradesh India. Int J Pharm Life Sci 2013; 4.
37. Navaneethan P, Nautiyal S, Kalaivani T, Rajasekaran C. Cross-cultural ethnobotany and conservation of medicinal and aromatic plants in the Nilgiris, Western Ghats: A case study. Med Plants 2011; 3: 27-45.
38. Prashantkumar P, Vidyasagar G. Documentation of traditional knowledge on medicinal plants of Bidar district, Karnataka 2014.
39. Jain AK, Vairale MG, Singh R. Folklore claims on some medicinal plants used by Bheel tribe of Guna district Madhya Pradesh. Indian J Tradit Know 2010; 9: 105-107.
40. Kumar A, Pandey VC, Singh AG, Tewari DD. Traditional uses of medicinal plants for dermatological healthcare management practices by the Tharu tribal community of Uttar Pradesh, India. Genet Resour Crop Ev 2013; 60: 203-224.
41. Bhat R, Etejere E, Oladipo V. Ethnobotanical studies from central Nigeria. Econ Bot 1990; 44: 382-390.
42. Nda-Umar UI, Gbate M, Umar AN, Mann A. Ethnobotanical study of medicinal plants used for the treatment of malaria in nupeland, north central Nigeria. Global J Res. Med. Plants & Indigen. Med 2014; 3: 112.
43. Attah AF, O'Brien M, Koehbach J, Sonibare MA, Moody JO, Smith TJ, Gruber CW. Uterine contractility of plants used to facilitate childbirth in Nigerian ethnomedicine, J Ethnopharmacol 2012; 143: 377-382.
44. Ebenezer IO. Preliminary Investigations on the Ethnomedicinal Plants of Akoko Division, South West Nigeria. Glob. J. Hortic. Sci 2011; 3: 84-89.
45. Olorunnisola O, Adetutu A, Balogun E, Afolayan A. Ethnobotanical survey of medicinal plants used in the treatment of malarial in Ogbomoso, Southwest Nigeria. J Ethnopharmacol 2013; 150: 71-78.
46. Brown WH. Minor products of Philippine forests, Department of Agriculture and Natural Resources Bureau of Forestry. Manila 1921.
47. Stuartxchange. Philippine Medicinal Plants. 2014.
48. Kerharo J, Adam J. La pharmacopée sénégalaise traditionnelle, plantes médicinales et toxiques Edition Vigot frère. Paris, France, 1974.
49. Chhabra S, Mahunnah R, Mshiu E. Plants used in traditional medicine in Eastern Tanzania. III, Angiosperms (Euphorbiaceae to Menispermaceae). J Ethnopharmacol 1990; 28: 255-283.
50. Neamsuvan O, Singdam P, Yingcharoen K, Sengnon N. A survey of medicinal plants in mangrove and beach forests from sating Phra Peninsula, Songkhla Province, Thailand. J Med Plants Res 2012; 6: 2421-2437.
51. Wong W. Some folk medicinal plants from Trinidad. Econ Bot 1976; 30: 103-142.
52. Clement Y, Baksh-Comeau Y, Seaforth C. An ethnobotanical survey of medicinal plants in Trinidad. J Ethnobiol Ethnomed 2015; 11: 1.
53. Picking D, Delgoda R, Boulogne I, Mitchell S. Hyptis verticillata jacq: a review of its traditional uses, phytochemistry, pharmacology and toxicology. J Ethnopharmacol 2013; 147(1): 16-41.
54. Nelsondooley B. The ethnomedical use of black drink to treat iron deficiency anemia in bastimentos, panama. Dooley 2004.
55. Prasanna S, Koppula S. Antimicrobial and preliminary phytochemical analysis of solvent extracts of Hyptis suaveolens from banks of River Krishna. Int. J. Bio-Pharmacol. Res 2012; 1: 11-15.
56. Ijeh I, Edeoga H, Jimoh M, Ejeke C. Preliminary phytochemical, nutritional and toxicological studies of leaves and stems of Hyptis suaveolens. Res J Pharmacol 2007; 1: 34-36.
57. Aspinall GO, Capek P, Carpenter RC, Gowda DC, Szafranek J. A novel l-fuco-4-o-methyl-d-glucurono-d-xylan from hyptis suaveolens. Carbohydr Res 1991; 214: 107-113.
58. Peerzada. Chemical composition of the essential oil of hyptis suaveolens. Molecules 1997; 2: 165-168.
59. Asekun O, Olusegun Ekundayo. Essential oil constituents of Hyptis suaveolens (l.) poit. (bush tea) leaves from nigeria. J Essent Oil Res 2000; 12: 227-230.
60. Lassine Sidib Ã, Jean-Claude Chalchat, Raymond-Philippe Garry, Moussa Harama. Aromatic plants of mali (iii): chemical composition of essential oils of two Hyptis species: h. suaveolens (l.) poit. and h. spicigera lam. J Essent Oil Res 2001; 13: 55-57.
61. Azevedo NR, Campos IF, Ferreira HD, Portes TA, Santos SC, Seraphin JC, Paula JR, Ferri PH. Chemical variability in the essential oil of hyptis suaveolens. Phytochemistry 2001; 57: 733-776.
62. Azevedo NR, Campos IFP, Ferreira HD, Portes TA, Seraphin JC, Paula JRD, Santos SC, Ferri PH. Essential oil chemotypes in hyptis suaveolens, from brazilian cerrado. Biochem Syst Ecol 2002; 30: 205-216.
63. Malele RS, Mutayabarwa CK, Mwangi JW, Thoithi GN, Lopez AG. Essential oil of hyptis suaveolens (l.) poit. from Tanzania: composition and antifungal activity. J Essent Oil Res 2003; 15: 438-440.
64. Eshilokun AO, Kasali AA, Giwa-Ajeniya AO. Chemical composition of essential oils of two hyptis suaveolens, (l.) poit leaves from Nigeria. Flavour Frag J 2005; 20: 528–530.
65. Grassi P, Nuñez MJ, Varmuza K, Franz C. Chemical polymorphism of essential oils of hyptis suaveolens from el salvador. Flavour Frag J 2005; 20: 131-135.
66. Tchoumbougnang F, Zollo PHA, Boyom FF, Nyegue MA, Bessière JM, Menut C. Aromatic plants of tropical central africa. xlviii. comparative study of the essential oils of four hyptis species from cameroon: h. lanceolata poit. h. pectinata (l.) poit. h. spicigera lam. and h. suaveolens poit. Flavour Frag J 2005; 20: 340-343.
67. Chukwujekwu JC, Smith P, Coombes PH, Mulholland DA, Van SJ. Antiplasmodial diterpenoid from the leaves of hyptis suaveolens. J Ethnopharmacol 2005; 102: 295-297.

68. Martins FT, Santos MHD, Polo M, Barbosa LCDA. Chemical variation in the essential oil of hyptis suaveolens (l.) poit. under cultivation condition. Quím Nova 2006; 29: 1203-1209.
69. Koba K, Raynaud C, Millet J, Sanda JPCK. Chemical composition of hyptis pectinata l. h. lanceolata poit, h. suaveolens (l) poit and h. spicigera lam. essential oils from togo. J Essent Oil Bear Pl 2007; 10: 357-364.
70. BeenaJoy, Omanakutty M, Mathew M. Antibacterial Effects and Chemical Composition of the Essential Oil of Hyptis suaveolens Poit Leaves. J Essent Oil Bear Pl 2008; 11: 384-390.
71. Grassi P, Nuñez MJ, Reyes TSU, Franz C. Chemical variation in the essential oil composition of hyptis suaveolens (l.) poit. (lamiaceae), Nat Prod Commun 2008; 3: 1137-1140.
72. Akinolao O, Sundayo O, Guido F, Pierl C, Isiakaa O, Olayinky ET. Essential oil-bearing plants from Nigeria: studies on vernonia perrottettii (leaf and stem bark), young leaves from eucalyptus decaisneana and immature leaves of hyptis suaveolens. J Essent Oil Res 2009; 21: 154-158.
73. Kossouoh C, Moudachirou M, Adjakidje V, Chalchat JC, Figuérédo G. A comparative study of the chemical composition of the leaves and fruits deriving the essential oil of Hyptis suaveolens (l.) poit. from benin. J Essent Oil Res 2010; 22: 507-509.
74. Moreira ACP, Lima EDO, Wanderley PA, Carmol ES, Souza ELD. Chemical composition and antifungal activity of Hyptis Suaveolens (L.) Poit leaves essential oil against Aspergillus species. Braz J Microbiol 2010; 41: 28.
75. Conti B, Canale A, Cioni PL, Flamini G, Rifici A. Hyptis suaveolens, and Hyptis spicigera, (lamiaceae) essential oils: qualitative analysis, contact toxicity and repellent activity against sitophilus granarius, (l.) (coleoptera: dryophthoridae). J Pest Sci 2011; 84: 219-228.
76. Benelli G, Flamini G, Canale A, Molfetta I, Cioni PL, Conti B. Repellence of hyptis suaveolens l. (lamiaceae) whole essential oil and major constituents against adults of the granary weevil sitophilus granarius (l.) (coleoptera: dryophthoridae). B Insectol 1967; 31: 177-183.
77. Prawatsri S, Suksamrarn A, Chindaduang A, Rukachaisirikul T. Abietane diterpenes from hyptis suaveolens. Chem Biodivers 2013; 10: 1494-1500.
78. Geovanna TG, Amner MA, Ana MC, Luisa FJ, Wilman AD. Componentes volátiles de Eriope crassipes, Hyptis conferta, H. dilatata, H. brachiata, H. suaveolens y H. mutabilis (Lamiaceae), Le problème de l'être chez Aristote: Presses. Universitaires de France 2014; 13: 727-730.
79. Islam AKMM, Ohno O, Suenaga K, Kato-Noguchi H. Suaveolic Acid: A Potent Phytotoxic Substance of Hyptis suaveolens. The Scientific World J 2014; 6.
80. Bojórquez-Velázquez E, Lino-López GJ, Huerta-Ocampo J A, Barrera-Pachecoc A, Barba de la Rosa AP, Moreno A, Mancilla-Margalli NA, Osuna-Castro JA. Purification and biochemical characterization of 11S globulin from chan (Hyptis suaveolens L. Poit) seeds. Food Chem 2016; 192: 203-211.
81. Kandpal V, Joshi PK, Joshi N. Chemical composition of leaf essential oil of Hyptis suaveolens (L.) Poit JICS 2017: 94: 201-203.
82. Praznik W, Čavarkapa A, Unger FM, Loeppert R, Holzer W, Viernstein H, Mueller M. Molecular dimensions and structural features of neutral polysaccharides from the seed mucilage of Hyptis suaveolens l. Food Chem 2017; 221: 1997-2004.
83. Ekow TN, Dzobo K, Adu F, Chirikure S, Wonkam A, Dandara C. Bush mint (hyptis suaveolens) and spreading hogweed (boerhavia diffusa) medicinal plant extracts differentially affect activities of cyp1a2, cyp2d6 and cyp3a4 enzymes. J Ethnopharmacol 2018; 211: 58.
84. Tang GQ, Liu XL, Gong X, Lin XJ, Lai XD, Wang D, Ji SG. Studies on the chemical compositions of Hyptis suaveolens (L.) Poit. J SERB CHEM SOC 2019; 84:245-252.
85. Sumitha KV, Thoppil JE. Genotoxicity assessment of two common curing weeds: Hyptis suaveolens, (L.) Poir. and Leucas indica, (L.) R. Br. Cytotechnology 2016; 68: 1-15.
86. Amusan AA, Idowu AB, Arowolo FS. Comparative toxicity effect of bush tea leaves (Hyptis suaveolens) and orange peel (Citrus sinensis) oil extract on larvae of the yellow fever mosquito Aedes aegypti. Tanzan Health Res Bull 2005; 7: 174-178.
87. Bezerra JWA, Costa AR, Silva MAPD, Rocha MI, Boligon AA. Chemical composition and toxicological evaluation of Hyptis suaveolens (l.) poiteau (lamiaceae) in drosophila melanogaster and artemia salina. S Afr J Bot 2017; 113: 437-442.