Pharmacogn Rev. 2021;15(29):69-75
A multifaceted peer reviewed journal in the field of Pharmacognosy and Natural Products
www.phcogrev.com | www.phcog.net

Plant Review

Pharmacological and Biochemical Aspects of the Lamiaceae Family used in the Treatment of Intestinal Parasitosis in West and Central Africa

Lissette Houedénou Degla[1,2], Pascal Abiodoun Olounlade[1,3,*], Abdou Madjid Olatoundé Amoussa[4], Erick Virgile Bertrand Azando[2,3], Mawule Sylvie Hounzangbe-Adote[2], Latifou Lagnika[4]

Lissette Houedénou Degla[1,2], Pascal Abiodoun Olounlade[1,3,*], Abdou Madjid Olatoundé Amoussa[4], Erick Virgile Bertrand Azando[2,3], Mawule Sylvie Hounzangbe-Adote[2], Latifou Lagnika[4]

[1]Zootechnical Research and Livestock System Unit, Laboratory of Animal and Fisheries Sciences, Doctoral School of Agricultural and Water Sciences, National University of Agriculture, 01 BP: 55 Porto-Novo, BENIN.
[2]Laboratory of Biochemistry and Bioactive Natural Substances, Faculty of Science and Technology, University of Abomey-Calavi, 04BP 0320, Cotonou, BENIN.
[3]Laboratory of Ethnopharmacology and Animal Health, Faculty of Agronomic Sciences, University of Abomey-Calavi, 01 BP 526 Cotonou, BENIN.
[4]Faculty of Agronomy, University of Parakou, 01 BP 123, Parakou, BENIN.

Correspondence

Dr. Pascal A Olounlade

[1]Zootechnical Research and Livestock System Unit, Laboratory of Animal and Fisheries Sciences, Doctoral School of Agricultural and Water Sciences, National University of Agriculture, 01 BP: 55 Porto-Novo, BENIN.

[3]Laboratory of Ethnopharmacology and Animal Health, Faculty of Agronomic Sciences, University of Abomey-Calavi, Cotonou, BENIN.

Phone no : 00229 97085468

E-mail: abiodouno@yahoo.fr.

History
- Submission Date: 28-03-2021;
- Review completed: 16-04-2021;
- Accepted Date: 31-05-2021.

DOI : 10.5530/phrev.2021.15.8

Article Available online
http://www.phcogrev.com/v15/i29

ABSTRACT
Background: In the search for new molecules likely to treat intestinal parasitosis with less risk in the short, medium and long term, the potential of medicinal plants is explored. and *Ocimum gratissimum* are two species of the Lamiaceae family used by populations of intestinal parasitosis from Benin. The aim of this work is to make a bibliographic synthesis of these two species in order to orient research for their use in the control of intestinal parasitosis. **Results and Conclusion:** *H. suaveolens* and *O. gratissimum* are endowed with nutrients, mineral compounds and secondary metabolites (flavonoids, alkaloids, tannins, phenolic compounds, saponins, steroids, glycosides, and essential oils). Antibacterial, antifungal, antioxidant, antiparasitic, antidiabetic, anticancer, antiulcer, wound healing and insecticidal activities are reported. The antimicrobial activities that are reported for *H. suaveolens* and *O. gratissimum* may justify their uses in the treatment of gastrointestinal disorders. The gastrointestinal disorders are manifestations but not specific of intestinal parasitosis. However, few studies have investigated the anthelmintic activities of these two species. A strong variation was also noted in the essential oils composition of *H. suaveolens* and *O. gratissimum*. This variation is the consequence of several chemotypes of essential oils which can influence the biological activities of the species. Further investigations are therefore important for the use of *H. suaveolens* and *O. gratissimum* in the control of intestinal parasitosis.
Key words: Anthelmintics, Essential oil, *Hyptis suaveolens*, Intestinal parasites *Ocimum gratissimum*, Africa.

INTRODUCTION

Intestinal parasitosis is a real health problem in both veterinary and human medicine.[1-3] In small ruminants, they cause production loss while threatening food security.[3,4] In humans, they contribute to the perpetuation of poverty by compromising the physical and intellectual development of children and reducing the work capacity and productivity of adults.[5,6] In general, the treatment of these intestinal parasitoses relies on the administration of synthetic drugs (including anthelmintics). However, these drugs have more and more limitations related to side effects and reported parasite resistances.[7-9] It is then convenient to search for new substances, effective, accessible, without toxicity and with a wide spectrum of action, to face these parasitoses and medicinal plants are a great asset.[2] Thus, an ethnobotanical survey conducted in Benin targeted the species *Hyptis suaveolens* and *Ocimum gratissimum* which are used in the treatment of human and small ruminant intestinal parasitosis. The aim of this work is to make a bibliographic synthesis of the uses, compositions, biological activities of the species *Hyptis suaveolens* and *Ocimum gratissimum* for a better exploitation in the treatment of human and small ruminant's intestinal parasitosis.

MATERIALS AND METHODS

The material consists of published scientific journals. The collection of these articles was done in the Google scholar engine. The articles are selected according to their relevance to the subject. Some data were summarized in tables for a better visibility and analysis.

RESULTS AND DISCUSSION

Generalities, Biochemical and chemical composition

Hyptis suaveolens is a perennial, aromatic branching herb 0.4-3m long with a hairy, hollow stem that bears glandular and non-glandular hairs characterized by a minty odor.[10-12] In most countries in which it is distributed, *H. suaveolens* is considered an invasive weed.[10,12-14] However, it has reported applications in traditional medicine. It is used in

Cite this article: Degla LH, Olounlade PA, Amoussa AMO, Azando EVB, Hounzangbe-Adote MS, Lagnika L. Pharmacological and Biochemical Aspects of the Lamiaceae Family used in the Treatment of Intestinal Parasitosis in West and Central Africa. Pharmacog Rev. 2021;15(29):69-75.

he treatment of respiratory, gastrointestinal, uterine infections, fever, burns cramps, skin lesions, malaria, weakness, kidney disorders, diabetes, headaches, jaundice hemorrhoid, breast abscesses and as an insecticide.[15-22] *Hyptis suaveolens* is rich in secondary metabolites which are flavonoids, alkaloids, tannins, phenolic compounds, saponins, steroids, glycosides and essential oils.[14,16,23,26] Also included are proteins, lipids, carbohydrates, fiber, ash;[27,25] mineral compounds such as potassium (K), nitrogen (N), calcium (Ca), Magnesium (Mg), Sodium (Na) phosphorus (P).[27] *Ocimum gratissimum* is an aromatic herb of the Lamiaceae family with a height of 1-3m. The leaves are broad and narrowly oval.[28] Widely used by people in cooking, *Ocimum gratissimum* is also involved in the preparation of medicinal recipes against fungal, urinary, HIV-1 infections, gonorrhea, bronchitis, vertigo, diarrhea, vomiting, respiratory, cardiovascular and liver diseases, fever, and malaria and as an insecticide.[28-32] Secondary metabolites present in *Ocimum gratissimum* are flavonoids, alkaloids, tannins, phenolic compounds, saponins, steroids, glycosides, and essential oils.[32-34,93] The presence of proteins, lipids, carbohydrates, fibers and mineral compounds that are Calcium (Ca), Magnesium (Mg), Potassium (K), Sodium (Na), Iron (Fe), Copper (Cu) and Zinc (Zn)[35,36] are also reported.

Variability of chemical compositions of essential oils

Essential oils extracted from *Hyptis suaveolens* and *ocimum gratissimum* experience a high variation in compounds. The essential oils of *Hyptis suaveolens* leaves collected in Benin are rich in β-caryophyllene, Eucalyptol, Sabinene, Fenchone.[37,38,22] It is noted a variation in chemical composition of essential oils. Indeed, according to the work of,[37] the predominant compounds are: β-caryophyllene, trans- α-bergamotene, caryophyllene oxide and bicyclogermacene. Following him,[38] reported: Sabinene, Eucalyptol, β-caryophyllene. And recently, according to,[22] the essential oils of *Hyptis suaveolens* leaves harvested in the south of the country are rich in monoterpoique compounds (Eucalyptol: 12.11%; fenchone: 11.81%) while those harvested in the center and north of the country are rich in sesquiterpenes with β-caryophyllene as the predominant compound (20.69-12.45%). However, there is a correlation between compound contents: when β-Caryophyllene content is low, Eucalyptol content is high (vice versa).[22]The variation in chemical compounds of *Hyptis suaveolens* essential oils is also observed in other countries of the world.[13,40] The oil of leaves and fruits from Vietnam was predominated β-caryophyllene, caryophyllene oxide, phytol and a-humulene.[41] The oil of leaves from Burkina-Faso was predominated Sabinène, β-Caryophyllen, Terpinolene.[39] This variability is due to the harvesting period, the edaphic characteristics related to the sampling station, the age of the plant.[22,38] It also influences the results obtained during the research work.[41,22] The essential oils of *Ocimum gratissimum* harvested in Benin, are rich in thymol, γ-terpinene and p-cymene.[29,42-46] Depending on the geographical areas, the harvest period, the chemical composition contents of *Ocimum gratissimum* essential oils experience a variation.[29] The stage of flowering, time of harvesting of the plant were also reported by[30] as factors of variation in the chemical composition contents of essential oils of *Ocimum gratissimum*. However, the compounds p-cymene, thymol, and g-terpinene present in the essential oils of *Ocimum gratissimum* can be easily converted to one or the other during the growth process, during the day, and after the plants are harvested.[30] The essential oil of leaves of *Ocimum gratissimum* from Brazil was predominated by Eugenol; 1, 8-Cineole;[71] by Thymole, γ-Terpinene, p-Cymene.[77] In Ivory Coast, the predominant compounds were Thymole, p-Cymene.[99] In Thaïlande it were Eugenole, cis-Ocimene, γ-muurolene.[98]

Pharmacological activities

Antimicrobial activities

Table 1 presents the antimicrobial activities evaluated on *Hyptis suaveolens* and *Ocimum gratissimum*. Different strains of micro-organisms are used to demonstrate the possible uses of extracts or essential oils of *Hyptis suaveolens* and *Ocimum grtissimum*. The result is that *Hyptis suavelons* and *Ocimum gratissimum* have a wide spectrum of action on pathogenic bacteria and fungi. The leaves are the most stressed organ. Figure 1 summarizes the most used micro-organisms in the evaluation of antimicrobial activities: *Bacillus subtilis; Candida albicans; Escherichia coli; Fusarium oxysporum; Staphylococcus aureus.* The essential oils of *Ocimum gratissimum* and *Hyptis suaveolens* are mostly used.

Antiparasitic activities

Table 2 presents the different antiparasitic activities that were evaluated on essential oils and extracts of *Hyptis suaveolens* and *Ocimum gratissimum* species. The parasites involved are protozoa (*Herpetomonas samuelpessoai*),[76] *Leishmania amazonensiss;*[67] mites *Rhipicephalus microplus*, *Rhipicephalus sanguinneus;*[68,69] ectoparasites[10] and helminths *Ascardia galli*, *Haemonchus contortus*, *Haemonchus placei.*[70,72]

The essential oil of *O. gratissimum*, were efficient in inhibiting eclodibility of *H. contortus* eggs[78] while the extract had a moderate action on adult *Haemonchus placei* worms.[72] The anthelminthic activity of the essential oil of *Ocimum gratissimum* would be due to Egenole. *Hyptis suaveolens* extract had paralyzed adult worms of *Ascardia galli* and *Pheretima posthuma.*[73]

Bioinsecticidal activity

The species *Hyptis suaveolens* and *Ocimum gratissium* can be used as bioinsecticides against field or food insect pests[11,39,79,80] and mosquito vectors of parasites.[25,81-86]

Antioxidant activities

Through the different techniques (DPPH; FRAP, ABTS), total phenols assay, it has been reported that the extracts and essential oils of *Hyptis suaveolens* and *Ocimum gratissimum* are endowed with the free radical scavenging abilities.[24,26,32,34,40,55,60,87] The antioxidant capacity average for all oil samples was about 75% of the thymol activity.[77]

Other activities

Hyptis suaveolens and *Ocimum gratissimum* have also been reported to have antidiarrheal,[88,89] antidiabetic;[16,19,90,91] anticancer;[40,92] antinflammatory,[15] antinociceptive, hepatoprotective, and in wound

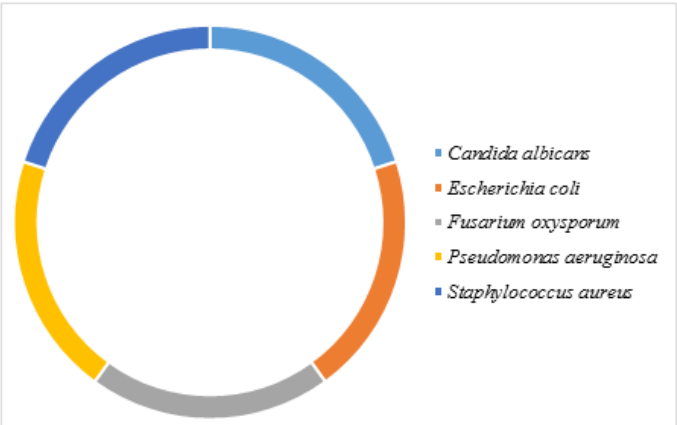

Figure 1: Species most commonly used in the evaluation of antimicrobial activities.

Table 1: Antimicrobial activity of *Hyptis suaveolens* and *Ocimum gratissimum*.

Plants	Parts	Species studied	Type of extract	Authors
Ocimum gratissimum	L	*Aeromonas hydrophila*	Et	[33]
Ocimum gratissimum	L	*Alternaria brassicicola*	EO	[47]
Hyptis suaveolens	L	*Antimycobacterium bovi*	EO	[48]
Hyptis suaveolens	L	*Aspergillus flavus*	EO	[17,49,50]
Ocimum gratissimum	L	*Aspergillus flavus*	Et; EO	[33,47,29, 49,46]
Hyptis suaveolens	P; L; S; R	*Aspergillus Niger*	Et; EO	[51,52,49, 23,53-55]
Ocimum gratissimum		*Aspergillus Niger*	EO	[44,49,46]
Hyptis suaveolens	L	*Aspergillus ochraceus*		[49]
Ocimum gratissimum	L	*Aspergillus ochraceus*	EO	[46,49]
Ocimum gratissimum	L	*Aspergillus tamarii*	EO	[29]
Hyptis suaveolens	L; F	*Bacillus cereus*	Et; EO	[56,55,41]
Ocimum gratissimum	L	*Bacillus cereus*	Et	[33]
Hyptis suaveolens	L	*Bacillus polymyxa*	Et;	[56]
Hyptis suaveolens	L	*Bacillus stearothermophilus*	Et;	[56]
Hyptis suaveolens	L	*Bacillus subtilis*	Et; EO	[40,54,56]
Ocimum gratissimum	L	*Bacillus* spp.	EO	[57]
Hyptis suaveolens		*Botrytis cinerea*	EO	[40]
Ocimum gratissimum	L	*Bipolaris oryzae*	EO	[47]
Ocimum gratissimum	L	*Botryodiplodia theobromae*	Et	[33]
Hyptis suaveolens	P; L; S; R; F	*Candida albicans*	Et; EO	[18,41,5,52, 54,55]
Ocimum gratissimum	L	*Candida albicans*	EO	[30,43,57,58]
Hyptis suaveolens	L	*Clostridium perfringens*	EO	[55]
Hyptis suaveolens	L	*Collectrotrichum capsici*	Et;	[18]
Hyptis suaveolens	P	*Cryptococcus*	Et;	[51]
Ocimum gratissimum	L	*Cryptococcus neoformans*	EO	[58]
Hyptis suaveolens	L; F	*Enterococcus faecalis*	Et; EO	[41,54,56]
Ocimum gratissimum	L	*Enterococcus faecalis*	EO	[43]
Hyptis suaveolens	L	*Epidermophyton floccosum*	Et;	[54]
Hyptis suaveolens	P; L; S; R	*Escherichia coli*	Et; EO	[17,18,52,40, 23,26,54]
Ocimum gratissimum	L	*Escherichia coli*	Et; EO	[33,100,44,43, 59,60,57,30, 61, 62,71,98]
Hyptis suaveolens	L	*Exerohilum turcicum*	EO	[40]
Hyptis suaveolens	P; L	*Fusarium*	Et;	[23,51]
Hyptis suaveolens	L	*Fusarium graminearum*	EO	[40,44,49]
Ocimum gratissimum		Fusarium graminearun		[49]
Hyptis suaveolens	L	*Fusarium oxysporum*	Et;	[18,49,63]
Ocimum gratissimum	L	*Fusarium oxsporium*	Et; EO	[33,44,49,49,64,46]
Ocimum gratissimum	L	*Fusarium moniliforme*	EO	[47]
Ocimum gratissimum	L	*Fusarium poae*	EO	[29,44]
Ocimum gratissimum	L	*Fusarium solani*	EO	[46,64]
Ocimum gratissimum	L	*Fusarium proliferatum*	EO	[47]
Ocimum gratissimum	L	*Fusarium verticillioides*	EO	[29,42,29]
Hyptis suaveolens	P; L; S; R	*Klebsiella pneumoneae*	Et;	[18,52]
Ocimum gratissimum	L	Klebsiella pneumoneae	EO	[57]
Hyptis suaveolens	L	*Lecannosticta acicola*	EO	[40]
Hyptis suaveolens	L	*Listeria monocytogenes*	Et ; EO	[17,55]
Ocimum gratissimum	L	*Listeria monocytogenes*	EO	[45]
Hyptis suaveolens	L	*Micrococcus luteus*	Et;	[56]
Ocimum gratissimum	L	*Macrophomina phaseolina*	EO	[64]
Ocimum gratissimum	L	*Microsporum canis*	EO	[58]
Ocimum gratissimum	L	*Microsporum gypseum*	EO	[58]
Ocimum gratissimum	L	*Malassezia pachydermatis*	EO	[58]
Hyptis suaveolens	L	*Phytophthora colocasiae*	Et;	[63]
Ocimum gratissimum	L	*Penicillium chrysogenum*	Et	[33]
Ocimum gratissimum	L	*Penicillium expansus*	EO	[65]
Ocimum gratissimum	L	*Penicillum verrucosum*	EO	[65]
Ocimum gratissimum	L	*Penicillium citrinum*	EO	[29]
Ocimum gratissimum	L	*Penicillium griseofulvum*	EO	[29]
Hyptis suaveolens	L	*Proteus vulgaris*	Et;	[23,54]
Ocimum gratissimum	L	*Pyricularia arisea*	EO	[47]
Hyptis suaveolens	P; L; S; R	*Pseudomonas aeruginosa*	Et; EO	[18,52,21,23, 54,40,55]
Ocimum gratissimum	L	*Pseudomonas aeruginosa*	Et; EO	[57,43,59,60]

Ocimum gratissimum	L	*Pyricularia arisea*	EO	[47]
Hyptis suaveolens	P; S; R	*Rhizophus stoloniphera*	Et;	[52]
Hyptis suaveolens	L	*Rhizopus*	Et;	[23]
Hyptis suaveolens	L;R	*Rhizopus nigricans*	Et;	[53]
Ocimum gratissimum	L	*Pyricularia arisea*	EO	[47]
Ocimum gratissimum	L	*Rhizoctonia solani*	EO	[47,64]
Ocimum gratissimum	L	*Rhizopus stolonifer*	Et	[33]
Hyptis suaveolens	L	*Salmonella typhimurium*	Et	[26]
Ocimum gratissimum	L	*Salmonella typhimurium*	Et; EO	[33,57,100, 60,98]
Ocimum gratissimum	L	*Scopulariopsis brevicaulis*	EO	[58]
Ocimum gratissimum	L	*Scytalidium dimidiatum*	EO	[58]
Hyptis suaveolens	P; L; S; R; F	*Staphylococcus aureus*	Et; EO	[17,18,52,21, 23,56,54,26, 40,55,41]
Ocimum gratissimum	L	*Staphylococcus aureus*	Et; EO	[57,30,43,44, 100,60,61,62, 71,98]
Hyptis suaveolens	L	*Serratia marcescens*	Et	[17]
Ocimum gratissimum	L	*T. interdigitale*	EO	[58]
Ocimum gratissimum	L	*T. rubrum*	EO	[58]
Ocimum gratissimum	L	*T. erinaceum*	EO	[58]
Ocimum gratissimum	L	*T. soudanense*	EO	[58]
Ocimum gratissimum	L	*T. violaceum*	EO	[58]
Hyptis suaveolens	L	*Trichophyton mentagrophytes*	Et;	[54]
Ocimum gratissimum	L	*Trichophyton mentagrophytes*	EO	[58]
Ocimum gratissimum	L	*Yersinia enterocolitica*,	Et	[33]

Legend: L: Leaf; S: Seed; R: Root; EO: Essential oil; Et: Extract

healing.[12] *Ocimum gratissimum* is reported to have beneficial actions on the immune system.[94]

Toxicity

Toxicity tests conducted on rats, showed that *Hyptis suaveolens* is not toxic.[16] According to the work of,[40] the essential oil of *Hyptis suaveolens* is toxic. However, according to the same author, this toxicity is beneficial in the treatment of cancers. It has been reported for *Ocimum gratissimum*, that it can be toxic.[61,93,95,96]

DISCUSSION

The species *Hyptis suaveolens* and *Ocimum gratissimum* of the Lamiaceae family have proven through various tests that they are endowed with antimicrobial, antioxidant, antiparasitic and insecticidal properties. Thus,

Table 2: Antiparasitic activities of *Hyptis suaveolens* and *Ocimum gratissimum*.

Plants	Species	Parasites	Extract	Authors
Hyptis suaveolens	*Pheretima posthuma*	Hemlminth	Et	[73]
	Ascardia galli		Et	[73]
	Rhipicephalus sanguinneus	Ascarian	Et	[68]
	Rhipicephalus (Boophilus) microplus		EO	[22,74]
Ocimum gratissimum	*Rhipicephalus lunulatus*		EO	[75]
Hyptis suaveolens		ectoparasite	Et	[10]
Ocimum gratissimum		Hemlminth	Et	[70]
	Haemonchus contortus	Hemlminth	EO	[76,78]
Ocimum gratissimum	*Haemonchus placei*	Hemlminth	Et	[72]
Ocimum gratissimum	*Rhipicephalus microplus*	Ascarian	EO	[69]
	Leishmania amazonensiss	Protozoa	EO	[77]
	Herpetomonas samuelpessoai	protozoa	EO	[66]
	Trypanosoma brucei brucei			[30]
	Plasmodium falcparum			

Legend: EO: Essential oil; Et: Extract

these two species can be used in several areas of life such as agriculture, industry, agri-food, health and livestock. Indeed, *Hyptis suaveolens* and *Ocimum gratissimum* can be used as bioinsecticides in the control of insect pests of fields[47,79,97] against insect vectors of parasites.[86] In Agri-food, *Hyptis suaveolens* can be used as a cereal preservative against aflatoxins [50, post-harvest protection of cabbage,[53] beef preservation[55] in the same way that *Ocimum gratissimum* can be involved in the protection of yam against rot,[81] conservation of local cheese "Wagachi".[29] It is noted that there is a correlation between the different results obtained. Indeed, the different micro-organisms used in the evaluation of antimicrobial activities, are responsible for the degradation of severalfood products, food and the cause of several diseases. Thus, the wide spectrum of antibacterial and antifungal activity of *Hyptis suaveolens* and *Ocimum gratissium* can justify their use in infectious diseases. These two species have not been studied as much for their antiparasitic activities. [70,76,68,10,69,72] According to an ethnobotanical study conducted in the DONGA, the species *Hyptis suaveolens* and *Ocimum gratissimum* are used in the treatment of human and small ruminant intestinal parasitosis in Benin. These observations are justified by the work of[73] and[76] who respectively demonstrated the anthelmintic activity of *Hyptis suaveolens* on *Pheretima posthuma* and *Ocimum gratissimum* on *Haemonchus contortus*. *Pheretima posthuma* is used as a model for studying human helminths. Also, anti-diarrheal activities of these two species have been reported.[20-89] Diarrhea is a manifestation but not specific to intestinal parasitosis. Diarrhea can also be associated with bacterial infections with *Staphylococcus aereus; Escherichia coli, Salmonella typhimurium*[72] (98; 100). In sum, *Hyptis suaveolens* and *Ocimum gratissimum* are good candidates for the research of new substances in the treatment of parasitic diseases and in particular intestinal parasitosis. However, the

results from the trials differ depending on the plant organ studied, the substance studied (extract, essential oils) the extraction solvent if it is an extract and also the type of micro-organism (Gram Positive bacteria, Gram Negative; fungus), parasites, insects involved.[56,52,23,54,41] It is in this vein that a harmonization of laboratory research is important to quantify the level of research progress and its directions for useful purposes. There is also a wide variation in the composition of essential oils, even within a given country.[13,22] These observed differences could be related to edaphic conditions and explained by chemical polymorphism.[98] According to,[13] latitude would be the most important environmental factor influencing the essential oil content. However, in Africa the essential oil of *Hyptis suaveoloens* seems to be characterized by the presence of βcaryophyllene.[101]

It would be very important to map the essential oil chemotypes of each aromatic plant with interesting biological properties; this would allow valuation and large-scale use of these aromatic plants.

CONCLUSION

The species *Hyptis suaveolens* and *Ocimum gratissimum* are endowed with several biological activities which justifies their uses in several fields. They are used by the populations in the treatment of intestinal parasitosis in Benin. The evaluation of their antiparasitic properties against intestinal parasites is important for their better use.

ACKNOWLEDGEMENT

The authors are grateful for the financial and technical assistance provided by The Kerala Veterinary and Animal Sciences University for conducting the research work.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

1. Olounladé PA, Azando EVB, Hounzangbé-Adoté MS, Tam Ha TB, Leroy E, Moulis C. *In vitro* anthelmintic activity of the essential oils of *Zanthoxylum zanthoxyloides* and *Newbouldia laevis* against *Strongyloides ratti*. Parasitol Res. 2012;110(4):1427-33.
2. Garba ABH, Arya MAG, Traore A, Ouedraogo S. Etude des effets vermicide et anti-diarrhéique du macéré aqueux des feuilles de *Salvadora persica* L. (Salvadoraceae). Int J Biol Chem Sci. 2007;11(1):54-66.
3. Akouedegni CG, Daga FD, Olounlade PA, Allowanou GO, Ahoussi E, Tamboura H, *et al*. Evaluation *in vitro* et *in vivo* des proprietés anthelminthiques de feuilles de *Spondias mombin* sur *Haemonchus contortus* des ovins djallonke. Agro Afr. 2019;31(2):213-22.Alowanou GG, Olounladé AP Koudandé OD, Babatoundé S, Hounzangbé-Adoté MS. Effets de la digestion dans le rumen sur les propriétés anthelminthiques de *Bridelia ferruginea* (Benth.), *Mitragyna inermis* (Willd.) Kuntze et *Combretum glutinosum* (Perr. EX DC.) Rev Cames. 2015;3(2):50-6.
4. Soumana A, Kamaye M, Saidou D, Dima H, Daouda B, Guéro T. Les parasitoses intestinales chez les enfants de moins de cinq ans à Niamey au Niger. Mali Medical. 2016;31(4):18-24.
5. Sylla K, Tine RCK, Sow D, Lelo S, Ndiaye LA, Faye BT, *et al*. Epidemiological Profile of Intestinal Parasitic Infection among Preschool and School Children Living in a Rural Community in Senegal: A Cross Sectional Survey. J Bacteriol Parasitol. 2018;9(4).
6. Paraud C. La résistance aux anthelminthiques des strongles gastro-intestinaux chez les petits ruminants laitiers élevés au pâturage. Anses – Les Cahiers de la Recherche N° 10 - Santé, Environnement, Travail. 2017;56-8.
7. Furtado LFV, Medeiros CS, Zuccherato LW, Alves WP, Oliveira DVNGM, Silva DVJ. First identification of the benzimidazole resistance-associated F200Y SNP in the betatubulin gene in *Ascaris lumbricoides*. PLoS One. 2019;14(10):1-11. e0224108.https://doi.org/10.1371/journal. pone.0224108.
8. Aguerre S. Résistance génétique aux nématodes gastro-intestinaux chez les ovins : évaluation des stratégies de sélection et de leur impact à l'échelle de l'élevage. Doctorat de L'Université de Toulouse. Institut National Polytechnique de Toulouse (Toulouse INP). 2019;172.
9. Chindo M, Ibrahim IAA. Competence of *Hyptis Suaveolens* Leaf Extract on Treatment of Ecto-Parasites (Fleas) on Farm Animals (Goat). European Reviews of Chemical Research. 2017;4(2):36-40. DOI: 10.13187/ercr.2017.2.36.
10. Appiah SP, Mbatchou VC, Dickson A, Asiedu FA. Pesticidal Effects of Extracts from *Hyptis suaveolens* and *Hyptis spicigera* on Cowpea Weevils. IJEAB. 2018;3(5):1691-9.
11. Li R, Tang G, Liu X, Li J, Wang D, Ji S. An ethnopharmacological review of *Hyptis suaveolens* (L.) Poit. Trop J Pharm Res. 2020;19(7):1542.
12. Azevedo NR, Campos IFP, Ferreira HD, Portes TA, Santos SC, Seraphin JC, *et al*. Chemical variability in the essential oil of *Hyptis suaveolens*. Phytochemistry. 2001;57(5):733-6.
13. Priya DM. A review on the pharmacology and phytochemistry of folklore medicinal plant *Hyptis suaveolens* (l.) Poit. IJBAIR. 2015;4(4):108-17.
14. Grassi P, Reyes UTS, Sosa S, Tubaro A, Hofer O, Zitter-Eglseer K. Anti-Inflammatory activity of two diterpenes of *Hyptis suaveolens* from El-Salvador. Z. Naturforsch. 2006;61(3-4):165-70.
15. Danmalam UH, Abdullahi LM, Agunu A, Musa KY. Acute toxicity studies and hypoglycemic activity of the methanol extract of the leaves of *Hyptis suaveolens* POIT. (Lamiaceae). Nig Journ Pharm Sci. 2009;8(2):87-92.
16. Statish V, Ravichandrian VD, Gavani U, Paarakh MP. Antimicrobial studies on the extracts of *Cocculus hirsutus* Linn. and *Hyptis suaveolens* Poit. Indian J Nat Prod Ressour. 2010;(1):49-52.
17. Pachkore GL, Dhale DA, Dharasurkar AN. Antimicrobial and phytochemical screening of *Hyptis suaveolens* (L.Poit) Lamiaceae. Internat. Multidiscipl Res J. 2011;1(4):01-3.
18. Mishra SB, Verma A, Mukerjee A, Vijayakumar M. Anti-hyperglycemic activity of leaves extract of *Hyptis suaveolens* L. Poit in streptozotocin induced diabetic rats. Asian Pac J Trop Med. 2011;4(9):689-93.
19. Shaikat ZH, Hossain T, Azam G. Phytochemical Screening and Antidiarrhoeal Activity of *Hyptis suaveolens*. Int J Appl Res Nat Prod. 2010;5(2):1-4.
20. Goly KRC, Soro Y, Dadie A, Kassi ABB and DJE M. Antibacterial activity of essential oils and extracts from the leaves of *Hyptis suaveolens* and *Lippia multiflora* on multi-resistant bacteria. Rasayan J Chemic. 2015;8(4):396-403.
21. Salifou S, Houngnimassoun HMA, Dotche IO, Attindehou S, Salifou S. Larvicide activity of two chemotypes of *Hyptis suaveolens* (Lamiaceae) poit, 1806 and alphacypermethrin on larvae of *Rhipicepalus* (Boophilus) *microplus* (Can., 1887) (Acari: ixodidae). Journal of Entomology and Zoology Studies. 2020;8(2):790-4.
22. Mozhiyarasi P, Anuradha R. A study on phytochemical analysis and antimicrobial activity of *Hyptis suaveolens* (L.) poit. J Chem Pharm Res. 2016;8(6):438-42.
23. Ghaffari H, Ghassam BJ, Nayaka SC, Kini KR, Prakash HS. Antioxidant and Neuroprotective Activities of *Hyptis suaveolens* (L.) Poit. Against Oxidative Stress-Induced Neurotoxicity. Cell Mol Neurobiol. 2014;34(3):323-31.
24. Abagale SA, Sackey I, Esuah MC, Lassey K. Comparative mosquito repellency of dried leaves of *Hyptis suaveolens* , *Cassia obtusifolia* , *Striga hermonthica* from the upper east region of Ghana and two standard repellants. J Asian Sci Res. 2017;7(12):459-70.
25. Oscar SA, Antonio CN, Marina GV, Elsa RS, Gabriel VA. Phytochemical screening, antioxidant activity and *in vitro* biological evaluation of leave extracts of *Hyptis suaveolens* (L.) from south of Mexico. S Afr J Bot. 2020;128:62-6.
26. Edeoga HO, Omosun G, Uche LC. Chemical composition of *Hyptis suaveolens* and *Ocimum gratissimum* hybrids from Nigeria. Afr J Biotechnol. 2006;5(10):892-5.
27. Idris S, Iyaka YA, Ndamitso MM, Paiko YB. Nutritional Composition of the Leaves and Stems of *Ocimum gratissimum*. JETEAS. 2011;2(5):801-5.
28. Sessou P, Farougou S, Alitonou G, Djenontin TS, Yèhouénou B, Azokpota P, *et al*. Chemical Composition and Antifungal activity of Essential oil of Fresh leaves of *Ocimum gratissimum* from Benin against six Mycotoxigenic Fungi isolated from traditional cheese *wagashi*. Res J Biological Sci. 2012;1(4):22-7.
29. Kpoviessi KBGH, Ladekan YE, Kpoviessi DSS, Gbaguidi F, Yehouenou B, Quetin-Leclercq J, *et al*. Chemical Variation of Essential Oil Constituents of *Ocimum gratissimum* L. from Benin and Impact on Antimicrobial Properties and Toxicity against *Artemia salina* Leach. Chem Biodivers. 2012;9(1):139-50.
30. Monga S, Dhanwal P, Kumar R, Kumar A, Chhokar V. Pharmacological and physico-chemical properties of Tulsi (*Ocimum gratissimum* L.): An updated review. The Pharm Innov. 2017;6(4):181-6.
31. Airaodion AI, Ibrahim AH, Ogbuagu U, Ogbuagu EO, Awosanya OO, Akinmolayan JD, *et al*. Evaluation of Phytochemical Content and Antioxidant Potential of *Ocimum gratissimum* and *Telfairia occidentalis* Leaves. AJRIMPS. 2019;7(1):1-11.
32. Junaid SA, Olabode AO, Onwuliri FC, Okwori AEJ, Agina SE. The antimicrobial properties of *Ocimum gratissimum* extracts on some selected bacterial gastrointestinal isolates. Afr J Biotechnol. 2006;5(22):2315-21.
33. Kpètèhoto HW, Amoussa AMO, Johnson RC, Houéto EEM, Mignanwandé FMZ, Yédomonhan H, *et al*. Phytochemical analysis and antioxidant potential of *Ocimum gratissimum* Linn (Lamiaceae) commonly consumed in the Republic of Benin. J Appl Biol Biotechnol. 2019;7(04):75-83.
34. Olumide MD, Ajayi OA, Akinboye OE. Comparative study of proximate, mineral and phytochemical analysis of the leaves of *Ocimum gratissimum*, *Vernonia amygdalina* and *Moringa oleifera*. J Med Plants Res. 2019;13(15):351-6.
35. Alexender P. Phytochemical screening and mineral composition of the leaves of *Ocimum gratissimum* (scent leaf). Int J Appl Sci Biotechnol. 2016;4(2):161-5.
36. Kossouoh C, Moudachirou M, Adjakidje V, Chalchat JC, Figueredo GA Comparative study of the chimical composition of the leaves and fruits deriving

the essential oil of *Hyptis suaveolens* (L.) Poit. From Benin. 2010;22(6):507-9.
37. Noudogbessi JP, Agbangnan P, Yehouenou B, Adjalian E, Nonviho G, Osseni AM, *et al*. Physico-chemical properties of *Hyptis suaveolens* essential oil. Int J Med Arom Plants. 2013;3(2):191-9.
38. 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(2):219-28.
39. Xu DH, Huang YS, Jiang DQ, Yuan K. The essential oils chemical compositions and antimicrobial, antioxidant activities and toxicity of three *Hyptis* species. Pharm Biol. 2013;51(9):1125-30.
40. Chung NT, Huong LT, Dai DN, Ogunwande IA. Chemical Compostions of Essential Oils and Antimicrobial Activity of *Hyptis suaveolens* (L.) Poit. (Lamiaceae) from Vietnam. EJMP. 2020;31(8):114-23.
41. Fandohan P, Gbenou JD, Gnonlonfin B, Hell K, Marasas WFO, Wingfield MJ. Effect of Essential Oils on the Growth of *Fusarium verticillioides* and *Fumonisin Contamination* in Corn. J Agric Food Chem. 2004;52(22):6824-9.
42. Baba-Moussa F, Adjanohoun A, Adéoti K, Gbénou J, Aloukoutou D, Kpavodé L, *et al*. Antimicrobial properties and phytochemical profiling of essential oils extracted from traditionally used medicinal plants in Benin. Int J Nat Prod Sci. 2012;2(4):1-11.
43. Houinsou RL, Ahoussi E, Sessou P, Yèhouénou B, Sohounhloué D. Antimicrobial activities of essential oil extracted from leaves of *Ocimum gratissimum* L. against pathogenic and adulterated microorganisms associated to tomato in Benin. IJB. 2012;2(11):90-100.
44. Mith H, Yayi-Ladékan E, Kpoviessi SDS, Bokossa IY, Moudachirou M, Daube G, *et al*. Chemical Composition and Antimicrobial Activity of Essential Oils of *Ocimum basilicum*, *Ocimum canum* and *Ocimum gratissimum* in Function of Harvesting Time. TEOP. 2016;19(6):1413-25.
45. Atrevy BC, Dègnon RG, Kpatinvoh B, Adjou ES, Gangbe MC, Allagbe A, *et al*. Efficacy of some essential oils in the fight against strains of mould extracted from smoked fish taken in South Benin. International Journal of Fisheries and Aquatic Studies. 2020;8(3):22-7.
46. Piyo A, Udomsilp J, Khang-Khun P, Thobunluepop P. Antifungal activity of essential oils from basil (*Ocimum basilicum* Linn.) and sweet fennel (*Ocimum gratissimum* Linn.): Alternative strategies to control pathogenic fungi in organic rice. As J Food Ag-Ind. 2009;S2-9.
47. Runde M, Kubmarawa D, Maina H. Compositional analysis and Antimycobacterium Tuberculosis Activity of Essential Oil of *Hyptis Suaveolens* Lamiceae. Res J Chem Sci. 2015;5(7):40-4.
48. Adjou ES, Aoumanou MM. Efficacité des extraits de plantes dans la lutte contre les moisissures toxinogènes isolées de l'arachide en post-récolte au Bénin. J Appl Biosci. 2013;70:5555-66.
49. Moreira ACP, Carmo ES, Wanderley PA, Souza DEL, Oliveira DLE. Inhibitory Effect of the Essential Oil from *Hyptis suaveolens* (L.) Poit on the Growth and Aflatoxins Synthesis of *Aspergillus flavus*. J Life Sci. 2013;7(3):276-81.
50. Mbatchou VC, Abdulatif S, Glover R. Phytochemical screening of solvent extracts from *Hyptis suaveolens* LAM for Fungal growth inhibition. Pak J Nut. 2010;9(4):358-61.
51. Prasanna SRV, Koppula SB. Antimicrobial and Preliminary Phytochemical Analysis of Solvent Extracts of *Hyptis suaveolens* from Banks of River Krishna. IJBPR. 2012;1(1):11-5.
52. Agbawodike CR, Sobowale AA, Gbolagade JS, Aguzie ION. *In vitro* inhibitory potentials of aqueous and ethanol extracts of *Hyptis suaveolens* on fungi associated with postharvest spoilage of *Brassica oleracea*. Afr J Biotechnol. 2018;17(31):949-58.
53. Tulugu M, Sujatha B, Lakshmi BS. Anatomical, phytochemical and *in vitro* antimicrobial studies of *Hyptis suaveolens* L. Poit. of family Lamiaceae. Int J Bio-Pharm Res. 2019;8(6):2617-22.
54. Mihin HB, Somda MK, Kabore D, Sanon S, Akakpo AY, Semde Z, *et al*. Biopreservation of meat using the essential oil from *Hyptis suaveolens* Poit. (Lamiaceae) in Burkina Faso. Afr J Biotechnol. 2019;18(29):808-18.
55. Comfort OO, Johnson GH. Antimicrobial Potential of Extracts of *Hyptis suaveolens* (L) Poit. Leaves on Some Gram Positive Bacterial Isolates. JAMPS. 2017;12(4):1-11.
56. Matasyoha LG, Matasyoh JC, Wachira FN, Kinyua MG, Muigai TAW, Mukiama TK. Antimicrobial activity of essential oils of *Ocimum gratissimum* L. from different populations of Kenya. Afr J Trad CAM. 2008;5(2):187-93.
57. Koba K, Poutouli PW, Raynaud C, Sanda K. Antifungal Activity of the Essential Oils from *Ocimum gratissimum* L. Grown in Togo. J Sci Res. 2009;1(1):164-71.
58. Stanley MC, Ifeanyi OE, Chinedum OK, Chinenye ND. The Antibacterial Activity of Leaf Extracts of *Ocimum gratissimum* and *Sida acuta*. Intl J Microbiol Res. 2014;5(2):124-9.
59. Omodamiro OD, Jimoh MA. Antioxidant and Antibacterial Activities of *Ocimum gratissimum*. Am J Phytomedicine Clin Ther. 2015;12(3):10-9.
60. Houngbeme AG, Gandonou C, Yehouenou B, Kpoviessi SDS, Sohounhloue D, Moudachirou M, *et al*. Phytochemical analysis, toxicity and antibacterial activity of Benin medicinal plants extracts used in the treatment of sexually transmitted infections associated with HIV/AIDS. IJPSR. 2014;5(5):1739-45.
61. Melo RS, Azevedo AÁM, Pereira GAM, Rocha RR, Cavalcante RMB, MN Carneiro Matos and al. Chemical Composition and Antimicrobial Effectiveness of *Ocimum gratissimum* L. Essential Oil Against Multidrug-Resistant Isolates of *Staphylococcus aureus* and *Escherichia coli*. Molecules. 2019;24(3864):1-17.
62. Augusta OC, Nwakaego OC. Efficacy of Methanolic Leaf Extract of *Hyptis suaveolens* and *Moringa oleifera* in the Control of Soil-Borne Pathogens. ARRB. 2020;35(7):56-63.
63. Mohr FBM, Lermen C, Gazim ZC, Gonçalves JE, Alberton O. Antifungal activity, yield, and composition of *Ocimum gratissimum* essential oil. Genet Mol Res. 2017;16(1):gmr16019542.
64. Nguefack J, Dongmo LJB, Dakole CD, Leth V, Vismer HF, Torp J, *et al*. Food preservative potential of essential oils and fractions from *Cymbopogon citratus*, *Ocimum gratissimum* and *Thymus vulgaris* against mycotoxigenic fungi. Int J Food Microbiol. 2009;131(2-3):151-6.
65. Holetz FB, Ueda-Nakamura T, Filho BPD, Cortez DAG, Morgado-Díaz JA, Nakamura CV. Effect of Essential Oil of *Ocimum gratissimum* on the Trypanosomatid *Herpetomonas samuelpessoai*. Acta Protozool. 2003;42(4):269-76.
66. Ueda-Nakamura T, Mendonca-Filho RR, Morgado-Dıaz JA, Maza PK, Filho BPD, Cortez DAG, *et al*. Antileishmanial activity of Eugenol-rich essential oil from *Ocimum gratissimum*. Parasitol Int. 2006;55(2):99-105.
67. Ohimain EI, Angaye TCN, Bassey SE, Izah SC. Acaricidal Activities of *Hyptis suaveolens* and *Ocimum sanctum* Against African Dog Tick (*Rhipicephalus sanguinneus*). EJMP. 2015;8(3):149-56.
68. Lima AS, Milhomem MN, Monteiro OS, Arruda ACP, Castro DJAM, Fernandes YML, *et al*. Seasonal analysis and acaricidal activity of the thymol-type essential oil of *Ocimum gratissimum* and its major constituents against *Rhipicephalus microplus* (Acari: Ixodidae). Parasitol Res. 2018;117(1):59-65.
69. Nwosu CO, Ekeh NC, Adamu M. Anthelmintic efficacy of the aqueous extract of *Ocimum gratissimum* L. against Nematode parasites of small ruminants. Nig J Expt Appl Boil. 2005;6(2):145-8.
70. Silva DNMK, Carvalho VRDA, Matias EFF. Chemical Profile of Essential oil of *Ocimum gratissimum* L. and Evaluation of Antibacterial and Drug Resistance-modifying Activity by Gaseous Contact Method. Pharmacogn J. 2016;8(1):1-8.
71. Aderibigbe SA, Idowu SO. Anthelmintic activity of *Ocimum gratissimum* and *Cymbopogon citratus* leaf extracts against *Haemonchus placei* adult worm. J Pharmacy and Bioresources. 2020;17(1):8-12.
72. Nayak PS, Nayak S, Kar DM, Das P. *In vitro* anthelmintic activity of whole plant extracts of *Hyptis suaveolens* Poit. Journal of Current Pharmaceutical Research. 2010;2(2):50-1.
73. Hüe T, Cauquil L, Fokou HJB, Dongmo JPM, Bakarnga-Via I, Menut C. Acaricidal activity of five essential oils of Ocimum species on *Rhipicephalus (Boophilus) microplus* larvae. Parasitol Res. 2014. DOI 10.1007/s00436-014-4164-6.
74. Miégoué E, Tendonkeng F, Payne KV, Lemoufouet J, Kouam KM, Boukila B, *et al*. Acaricidal effect of foam soap containing essential oil of *Ocimum gratissimum* leaves on *rhipicephalus lunulatus* in the western highland of Cameroon. Bull Anim Hlth Prod Afr. 2013;61(4):535-41.
75. Hussien J, Urgessa K, Regassa F, Jemal A, Abajebel S, Hussien N. Antihelmentic effects of the essential oil extracts of selected plants against *Haemonchus contortus*. Int J Agric Res. 2011;6:290-8.
76. Castro DJAM, Monteiro OS, Coutinho DF, Rodrigues AAC, Silva DJKR, Mai JGS. Seasona land Circadian Study of a Thymol/γ-Terpinene/p-Cymene Type Oil of *Ocimum gratissimum* L. and Its Antioxidant and Antifungal Effect. J Braz Chem Soc. 2019;30(5):930-8.
77. Pessoa LM, Morais SM, Bevilaqua CML, Luciano JHS. Anthelmintic activity of essential oil of *Ocimum gratissimum* Linn. and eugenol against *Haemonchus contortus*. Vet. Parasitol. 2002;109(1-2):59-63.
78. Kossou DK, Atachi P, Zannou TE, Bougourou S. Evaluation de l'activité insecticide de deux plantes *Hyptis suaveolens* (Linn) et *Khaya senegalensis* (A. Juss) sur les insectes ravageurs du niébé (*Vigna unguiculata* L. Walp.). Sci Nat. 2007;4(1):17-26.
79. Adeniyi SA, Orjiekwe CL, Ehiagbonare JE, Arimah BD. Preliminary phytochemical analysis and insecticidal activity of ethanolic extracts of four tropical plants (*Vernonia amygdalina, Sida acuta, Ocimum gratissimum* and *Telfaria occidentalis*) against beans weevil (*Acanthscelides obtectus*). Int J Phys. 2010;5(6):753-62.
80. Okigbo RN, Ogbonnaya UO. Antifungal effects of two tropical plant leaf extracts (*Ocimum gratissimum* and *Aframomum melegueta*) on postharvest yam (Dioscorea spp.) rot. Afr J Biotechnol. 2006;5(9):727-31.
81. Oparaocha ET, Iwu I, Ahanaku JE. Preliminary study on mosquito repellent and mosquitocidal activities of *Ocimum gratissimum* (L.) grown in eastern Nigeria. J Vector Borne Dis. 2010;47(1):45-50.
82. Abagli AZ, Alavo TBC. Essential Oil from Bush Mint, *Hyptis suaveolens*, is as effective as DEET for Personal Protection against Mosquito Bites. The Open Entomol J. 2011;5(1):45-8.
83. Abagli AZ, Alavo TBC. Potentialités insectifuges du gros baume, *Hyptis suaveolens* Poit. (Lamiaceae): Perspectives pour la lutte contre les moustiques en zones tropicales. Journal of Applied Biosciences. ;149:15330-7.
84. Pratheeba T, Ragavendran C, Natarajan D. Larvicidal, pupicidal and adulticidal

potential of *Ocimum gratissimum* plant leaf extracts against filariasis inducing vector. Int J Mosq Res. 2015;2(2):01-8.

85. Ayange-kaa AB, Hemen TJ, Onyezili N. The Effect of Dried Leaves Extract of *Hyptis suaveolens* on Various Stages of Mosquito Development in Benue State, Nigeria. IOSR-JPBS. 2015;10(6):28-32.
86. Igbinosa EO, Uzunuigbe EO, Igbinosa IH, Odjadjare EE, Igiehon NO, Emuedo OA. *In vitro* assessment of antioxidant, phytochemical and nutritional properties of extracts from the leaves of *Ocimum gratissimum* (Linn). Afr J Tradit Complement Altern Med. 2013;10(5):292-8.
87. Olamide SO, Agu GC. The Assessment of the Antimicrobial Activities of *Ocimum Gratissimum* (Wild Basil) and *Vernonia Amygdalina* (Bitter Leaf) On Some Enteric Pathogen Causing Dysentery or Diarrhea in Patients. IJES. 2013;2(9):83-96.
88. Ezekwesili CN, Obiora KA, Ugwu OP. Evaluation of Anti-Diarrhoeal Property of Crude Aqueous Extract of *Ocimum gratissimum* L. (Labiatae) In Rats. Biokemistri. 2004;16(2):122-31.
89. Okon UA, Owo DU, Udokang NE, Udobang JA, Ekpenyong CE. Oral Administration of Aqueous Leaf Extract of *Ocimum gratissimum* Ameliorates Polyphagia, Polydipsia and Weight Loss in Streptozotocin-Induced Diabetic Rats. AJMSM. 2012;2(3):45-9.
90. Okoduwa SIR, Umar IA, James DB, Inuwa HM. Anti-Diabetic Potential of *Ocimum gratissimum* Leaf Fractions in Fortified Diet-Fed Streptozotocin Treated Rat Model of Type-2 Diabetes. Medicines. 2017;4(4):73.
91. Gurunagarajan S, Pemaiah B. Comparative studies on cytotoxic effect of *Hyptis suaveolens* Poit. and *Leonotis nepeatefolia* R.Br. against EAC cell lines. J Pharmacy Res. 2011;4(1):1222-4.
92. Kpadonou-Kpoviessi BGH, Kpoviessi DSS, Yayi-Ladekan E, Gbaguidi F, Yehouenou B, Mansourou M, *et al*. Phytochemical screening, antimicrobial activities and toxicity against *Artemia salina* Leach of extracts and fractions of *Ocimum gratissimum* Linn from Benin. J Chem Pharm Res. 2013;5(10):369-76.
93. Okojie RO, Eghafona NO. Assessment of *Ocimum gratissimum* leaves on Hematological parameters and Cell-mediated immunity of Rabbits. International Journal of Basic Science and Technology. 2016;2(1):46-9.
94. Orafidiya LO, Agbani EO, Iwalewa EO, Adelusola KA, Oyedapo OO. Studies on the acute and sub-chronic toxicity of the essential oil of *Ocimum gratissimum* L. leaf. Phytomedicine. 2004;11(1):71-6.
95. Fandohan P, Gnonlonfin B, Laleye A, Gbenou JD, Darboux R, Moudachirou M. Toxicity an gastric tolerance of essential oils from *Cymbopogon citratus*, *Ocimum gratissimum* and *Ocimum basilicum* in Wistar rats. Food Chem Toxicol. 2008;46(7):2493-7.
96. Adda C, Atachi P, Hell K, Tamò M. Potential use of the bushmint, *Hyptis suaveolens*, for the control of infestation by the pink stalk borer, *Sesamia calamistis* on maize in southern Benin, West Africa. J Insect Sci. 2011;11(1):33.
97. Chimnoi N, Reuk-ngam N, Chuysinuan P, Khlaychan P, Khunnawutmanotham N, Chokchaichamnankit D, *et al*. Characterization of essential oil from *Ocimum gratissimum* leaves: Antibacterial and mode of action against selected gastroenteritis pathogens. Microb Pathog. 2018;118:290-300. doi: 10.1016/j.micpath.2018.03.041.
98. Benellia G, Pavela R, Maggi F, Wandjou JGN, Fofie NBY, Koné-Bambae D, *et al*. Insecticidal activity of the essential oil and polar extracts from *Ocimum gratissimum* grown in Ivory Coast: Efficacy on insect pests and vectors and impact on non-target species. Ind Crops Prod. 2019;132:377-85.
99. Adebolu TT, Oladimeji SA. Antimicrobial activity of leaf extracts of *Ocimum gratissimum* on selected diarrhoea causing bacteria in southwestern Nigeria. Afr J Biotechnol. 2005;4(7):682-4.
100. Tonzibo ZF, Florence AB, Bédi G, Chalchat JC. Chemical Composition of Essential Oil of *Hyptis Suaveolens* is(L) Poit. from Côte d'Ivoire. Euro J Sci Res. 2009;38(4):565-71.

Cite this article: Degla LH, Olounlade PA, Amoussa AMO, Azando EVB, Hounzangbe-Adote MS, Lagnika L. Pharmacological and Biochemical Aspects of the Lamiaceae Family used in the Treatment of Intestinal Parasitosis in West and Central Africa. Pharmacog Rev. 2021;15(29):69-75.