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Medico-botany, Qualitative Phytochemistry, and Antioxidant Activity of some medicinally important Lamiaceae members from Vidarbha Region of Maharashtra (India)

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Abstract

The medico-botany, qualitative phytochemistry, and the antioxidant activity of some Lamiaceae members from Maharashtra state are presented in this paper. All the members of Lamiaceae are either herbs or shrubs and often with an aromatic odor. Thirteen members of Lamiaceae *i.e. Anisochilus carnosus, Anisomeles indica, Colebrookea oppositifolia, Coleus amboinicus, Hyptis suaveolens, Leonotis nepetifolia, Leucas aspera, Mentha arvensis, Ocimum gratisimum, Origanum vulgare, Plectranthus mollis, Pogostemon benghalensis,* and *Salvia plebeia* were collected and their crude leaves powders were used to assess their qualitative phytochemistry and antioxidant potential. All these plants have been used as a folk medicine for ages to cure various diseases and have diuretic, tonic, antispasmodic, antirheumatic, antimicrobial, antioxidant anti-inflammatory, and antiseptic properties. The chemical constituents include strong aromatic essential oils, tannins, saponins, organic acids, phenolics, and flavonoids. The antioxidant assay also suggested that all the selected members have significant antioxidant potential.

Key words : Aromatic, Antioxidant, Lamiaceae, Medico-botany, Phytochemistry.

Nature has provided human beings with a great repository of herbal medicine in the form of plants. Plants are the integral components of sophisticated Traditional Medicine systems that have been in existence for thousands of years and continue to provide remedies for various ailments. Some of the oldest known medicinal systems of the world such as Ayurveda of the Indus civilization, Arabian medicine of Mesopotamia, Chinese and Tibetan medicine of the Yellow River civilization of China, and Kempo of the

Japanese are all based mostly on plants[1]. Lamiaceae is one of the most diverse and widespread plant families in terms of ethnomedicine. Its medicinal value lies in its precise chemical composition with volatile oils as one of the components[2-3]. All members of this family are highly aromatic, due to the presence of external glandular structures that produce volatile oil[4,20]. This oil is important in the pesticide, pharmaceutical, flavoring, perfumery, fragrance, and cosmetic industries[19]. These plants also have some other chemical constituents like terpenes, saponins, tannins, phenolics, and flavonoids[8,11]. Which give medicinal properties to these plants. Such medicinal plants have an important value in the Socio-cultural, spiritual, and healthcare use in rural and tribal lives of developing countries[7].

People around the world use about 80,000 flowering plants for medicinal purposes[2]. Maharashtra is one of the prominent states in India, which has excellent plant diversity with a biodiversity hotspot *i.e.* Western Ghat. Most family members of Lamiaceae have spiritual and medicinal potential[10]. The flora of Maharashtra[25] recorded 15 species of Lamiaceae across the state. Therefore, the study was conducted to investigate the medico-botanical study of thirteen members of Lamiaceae, their fundamental groups of phytochemicals, and the antioxidant potential of leaf extract.

Thirteen species of Lamiaceae *i.e. Anisochilus carnosus, Anisomeles indica, Colebrookea oppositifolia, Coleus amboinicus, Hyptis suaveolense, Leonotis nepetifolia, Leucas aspera, Mentha arvensis, Ocimum gratissimum, Origanum vulgare, Pogostemon benghalensis and Salvia plebeia* species (Fig. 1) found in Vidarbha region of Maharashtra are selected for the ethnomedicinal studies. The medico-ethno-botanical data was collected from local peoples, herbal healers, and tribals inhabiting different patches in the vicinity of wild flora in the study area. A total 27 informants having an age group of about 40 years to 60 years were interviewed.

The selected plants were then collected and identified taxonomically using the flora of Maharashtra[25] and the flora of Marathwada[17]. The collected plant material was then shade-dried for about 8-10 days and later the material was powdered and kept in very safe air-tight polythene bags. Later it was used to study qualitative phytochemistry using standard protocols and then assess their antioxidant potential, especially in their leaves[15,23].

Qualitative phytochemistry :

Preliminary phytochemical analysis was done as per standard protocols:

Alkaloids: 1. About 2 ml of powdered extract was taken in a clean test tube and a few drops of dragendorff was added to it and weighed. A reddish-brown precipitate indicates the presence of an alkaloid in the sample (Dragendroff's test).

2. About 2 ml of powdered drug extract was taken in a clean test tube and then add a few drops of Mayer's reagent along the side of the test tube. A creamy white or yellowish precipitate indicates the presence of an alkaloid (Mayer's test).

Phenolics: 1. In 2 ml of powder extract, 2-3 drops of dilute iodine. If the phenolic compounds are present in the sample, the extract turns to transient red (Iodine test).

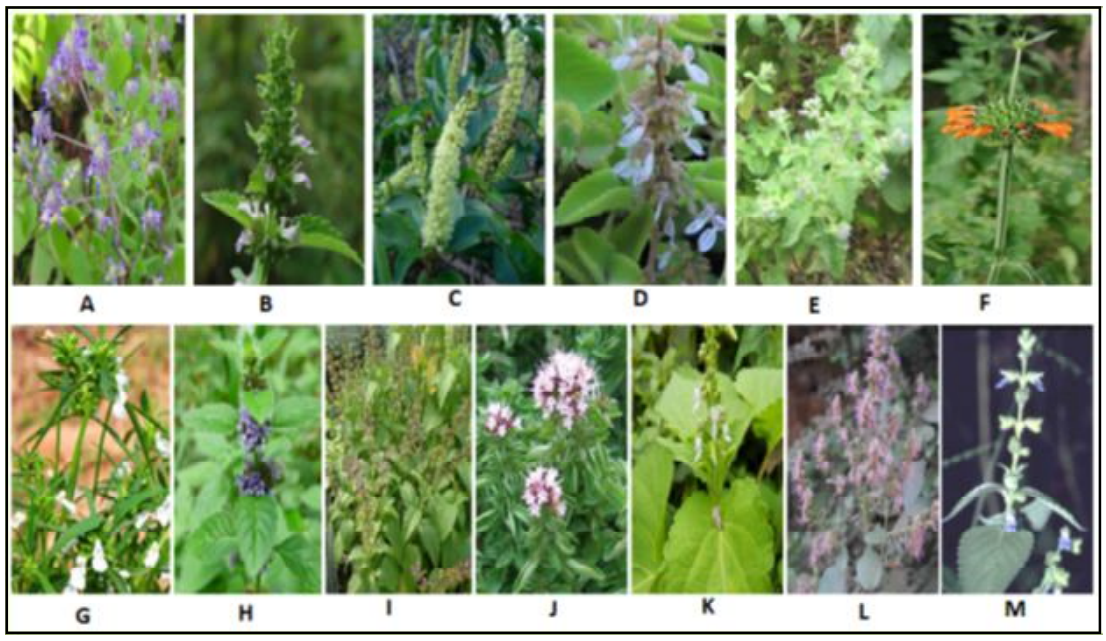


Fig. 1. Plants under study in their habitats: A. *Anisochilus carnosus,* B. *Anisomeles indica,* C. *Colebrookea oppositifolia,* D. *Coleus amboinicus,* E, *Hyptis suaveolens,* F. *Leonotis nepetifolia,* G. *Leucas aspera,* H. *Mentha arvensis,* I. *Ocimum gratissimum,* J. *Origanum vulgare,* K. *Plectranthus molis,* L. *Pogostemon benghalensis and* M. *Salvia plebeia.*

2. In about 5 ml of aqueous powder sample extract, add 2 ml of 10% lead acetate; if the reaction gives a white precipitate, it confirms the availability of phenolic compounds (Lead acetate test).

3. In about 5 ml aqueous powder sample extract, add 2 ml 5% ferric chloride, if the extract turns dark green or bluish-black, it confirms the availability of phenolics in the sample (Ferric chloride test).

Flavonoids: 1. In 1ml of plant extract add a few drops of 10% lead acetate, if it leads to yellow precipitate, it indicates the presence of flavonoids in a given sample (Lead acetate test).

2. In 1 ml powder extract, add 2 ml 2% Sodium hydroxide and a few drops of concentrated hydrochloride, the reaction gives an intense yellow precipitate indicating the presence of flavonoids (Alkaline reagent test).

3. Take 2 ml of plant extract and add 2 ml of concentrated H_2SO_4 carefully. If the color of the mixture changes to orange, it indicates the presence of flavonoids.

Terpenes: 1. 2-3 ml of plant extract mixed in 2ml chloroform and then add 2-3 ml concentrated Sulphurinc acid carefully forms a layer, and a reddish brown interface form indicates the presence of terpenes (Salkowski test).

Tannins: 1. Take 2ml of plant extract or powder and dissolve in 5 ml distilled water, then add 1ml 1% gelatin solution and 1ml

10% NaOH solution, if the white precipitate appears, it is a positive test for tannins (Gelatin test).

2. In about 10 ml of bromine water add about 0.5 ml plant extract, if the decoloration of reddish brown bromine water takes place, it is a positive test of the presence of tannins (Bromine water test).

Saponins: 1. 1ml plant extract was taken in about 15 ml of distilled water in a clean glass cylinder of the test tube; if the stable foam develops, it suggests the presence of saponins in the sample (Foam test).

Preparation of plant extracts :

About 100g of dried and powdered plant material were extracted at room temperature with 500 ml of methanol under constant shaking for 24 hrs. After filtration, the methanolic (MeOH) solutions were evaporated to dryness in a rotary evaporator for further phytochemical experimentations.

DPPH scavenging test :

Quantitative measurement of radical scavenging properties of plant leaves extract was done by the DPPH method [15-17]. The reaction mixture contained 50 µL of test samples (or 80% MeOH as a blank) and 5 ml of a 0.004% (w/v) solution of DPPH in methanol. A well-known antioxidant, Butylated hydroxytoluene (BHT, Sigma) was used as a positive control. The discoloration was measured at 517 nm after incubation for 30 min. Measurements were taken at least in triplicate. DPPH radical's concentration was calculated using the following equation:

DPPH scavenging effect (%) = $Ao - A_1/Ao \times 100$

Where Ao was the absorbance of the control and A_1 was the absorbance in the presence of the sample *i.e.* crude leaf extracts of selected Lamiaceae plants (Oktay *et al.*, 2003). The actual decrease in absorption induced by the test compounds was compared with the positive controls. The mean Optical Density (OD) at 517 nm results of DPPH scavenging against the logarithms of concentrations were plotted using the Microsoft Excel computer program, which also presents regression equations. The regression equations were used to calculate the IC_{50} value. DPPH scavenging effect was expressed in mg GAE/L.

During the survey of Lamiaceae members from the study area, the information generated through personal interviews regarding the medico-botanical values was analyzed and presented here. A total of 27 informants were interviewed from the Vidarbha region of Maharashtra, especially from the Satpuda ranges. the data was analyzed in light of recent scientific reports.

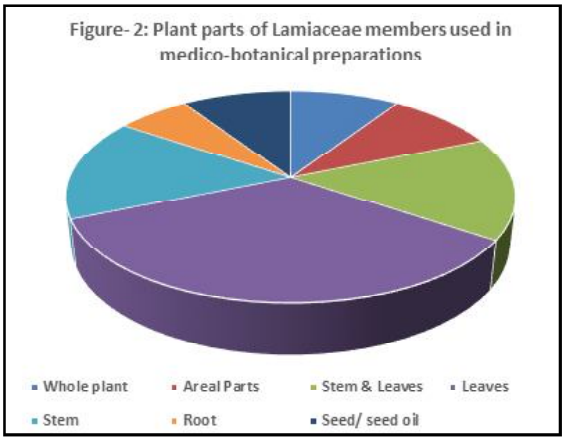
Medico-botanical importance :

The medico-botanical importance of the selected 13 Lamiaceae members is given in the table-1. Most members are reportedly used to cure regular coughs, colds, and fevers. Some members are also used as stimulants and blood purifiers while some plants are being used for wound healing, rheumatic pain, and antioxidants (Table-1). For the traditional treatment of these plants, mostly areal parts are being used (leaves, stems, flowers, etc.) while there are a few of which whole plants, as well as roots, are also found useful in medicine (Fig. 2). Sinhababu and Banerjee[26] reported

Table-1. Ethnomedicinal values of selected Lamiaceae members from Maharashtra

Sr.no.	Name of Plants	Parts used	Medicinal importance
1	*Anisochilus carnosus* (L.) Wall	Aerial parts	The leaves and areal parts of this plant are used traditionally to treat gastric ulcers and stomach pain.
2	*Anisomeles indica*, O. Kze.	Whole plant	In small kids, Leaves ask to chew for the treatment of toothaches. The juice of the aerial part is given to treat cold, fever, abdominal pain, intermittent fever, and dyspepsia. The paste is applied to cure rheumatic pain.
3	*Colebrookea oppositifolia* Sm.	Stem and Leaves	Plant leaf juice is used to treat fever and headache. Leaves are used to treat dysentery. Roots decoction is used to treat peptic ulcers and hemostatic. Leaves are used in the treatment of wounds, bruises, and fractures.
4	*Coleus amboinicus* Lour.	Whole plant	This plant is used to treat malarial fever, hepatopathy, renal & vesicle calculi, cough, chronic asthma, hiccough, bronchitis, helminthiasis, colic, convulsions, and arthritic inflammations.
5	*Hyptis suaveolens* Poit.	Stem, leaves, seeds, and roots	The leaves have been utilized as a stimulant, carminative, sudorific, galactagogue, and as a cure for parasitic cutaneous diseases. Crude leaf extract is used as a relief to colic and stomachache. Leaves and twigs paste is used to treat rheumatic pain. The decoction of the roots is highly valued as an appetizer and digestive.
6	*Leonotis nepetaefolia* R.Br.	Stem and leaves	Leaves are brewed as a tea for fever, coughs, and womb prolapse. The paste of the aerial part is used as an antiseptic.
7	*Leucas aspera*, Spreng.	Whole plant	The entire plant is used in traditional medicine for coughs, colds, painful swellings, and chronic skin eruptions. It possesses wound-healing properties and is used in cobra venom poisoning.

8	*Mentha arvensis* L.	Leaves and seed oil	The leaves are used as a flavoring in salads or cooked foods, often used in mint sauce, which is used as a flavoring in the meal. The seed oil is used in the treatment of bacterial and viral treatment internally.
9	*Ocimum gratissimum* L.	Stem, Leaves & Seeds	The plant is used for treating various types of diseases and lowering blood glucose and also treats cold, fever, parasitic infestations on the body and inflammation of joints and headaches. The leaf juice of Tulasi along with lemon juice is given to treat dysentery.
10	*Origanum vulgare* Linn.	Stem & Leaves	The juice of areal part of this plant is given to treat normal cough, cold and fever. It is also administered to treat bacterial & viral infections.
11	*Plectranthus mollis* Linn.	Areal parts	The plant is used to treat cough and the common cold. The paste of the areal part is used to treat skin infections. It is also useful in respiratory disorders.
12	*Pogostemon benghalensis* Kuntze.	Leaves and Roots	The leaf paste is used as an antiseptic to cure wounds & cuts. Root decoction is used in the treatment of Uterine hemorrhoids.
13	*Salvia plebeia* R. Br.	Aerial parts and seeds	The aerial part has wound-healing properties, paste is used as an antiseptic. The seeds are used in the treatment of gonorrhea, hemorrhoids, and diarrhea.



ethnomedicinal values of thirteen species belonging to 8 genera of Lamiaceae from the Bankura district of West Bengal India. Few other workers had demonstrated similar results from different geographical areas [9,24] also reported that Lamiaceae is a dominant family used for its ethnomedicinal uses in Haripur District, Khyber Pakhtunkhwa, Pakistan.

Qualitative Phytochemistry :

The Qualitative phytochemical analysis of all selected 13 Lamiaceae was done for the availability 06 major groups of phytochemicals *i. e.* alkaloids, phenolics, flavonoids, tannins, terpenes, and saponins. *Anisochilus carnosus* was found to have all analyzed phytochemicals with more levels of tannins. In *Anisomeles indica* leaf extracts, alkaloids and saponins are found in more concentration as compared to other phytochemicals. In *Colebrookea oppositifolia* leaf extracts, the flavonoid test was negative and all other tests were positive. *Coleus ambonicus* showed the presence of all tested phytochemicals comparatively more saponin. *Hyptis suaveolense* showed higher color intensity in the test of tannins and saponin with all other positive tests. In an extract of *L. nepetifolia*, tests of alkaloids, phenolics tannins, terpenes, and saponins were positive while that of flavonoids was negative. In an extract of *Ocimum gratissimum, Pogostemon benghalensis,* and *Mentha arvensis*, all tests were found positive. In the leaf extract of *Origanum vulgare* test for terpene was negative, in the *Plectranthus mollis* extract

Table-2. Qualitative phytochemistry of some Lamiaceae members from Vidarbha Maharashtra state

Sr. no.	Name of Plants	Presence or absence of phytochemical groups in methanol extract					
		Alkal-oids	Pheno-lics	Flavo-noids	Tan-nins	Terpe-nes	Sapon-ins
1	*Anisochilus carnosus* (L.) Wall	+	+	+	++	+	+
2	*Anisomeles indica*, O. Kze.	++	+	+	+	+	++
3	*Colebrookea oppositifolia* Sm.	+	+	-	+	+	+
4	*Coleus amboinicus* Lour.	+	+	+	+	+	++
5	*Hyptis suaveolens* Poit.	+	+	+	++	+	++
6	*Leonotis nepetaefolia* R.Br.	+	+	-	+	+	++
7	*Leucas aspera*, Spreng.	++	+	-	+	+	+
8	*Mentha arvensis* L.	+	+	+	+	+	+
9	*Ocimum gratissimum* L. (Ran- Tulas)	+	+	+	+	+	+
10	*Origanum vulgare* Linn.	+	+	+	+	-	+
11	*Plectranthus mollis* Linn.	+	+	-	+	+	+
12	*Pogostemon benghalensis* Kuntze.	+	+	+	+	+	+
13	*Salvia plebeia* R. Br.	+	+	-	+	-	+

test of flavonoid was negative while in *Salvia plebeia*, the test of flavonoids and terpenes was negative and all other tests were positive in these plant extracts (Table-2). Thus, the selected plants of Lamiaceae are rich in phytochemical composition. Koche *et. al.,*[10] have given the qualitative phytochemistry of three Lamiaceae members. Bendif *et. al.,* (2021) presented a review of phytochemicals present in different plants of the family Lamiaceae. Hajdari *et. al.,*[6] revealed the phytochemical composition of eight Lamiaceae members used in Tea making in the Sari Mountain regions of the Balkans. Recently, Sandhiya *et. al.,*[21] presented the detailed phytochemistry and bioactive phytochemicals from *Pogostemon benghalensis*.

Antioxidant Activity :

Further, all the leaf extracts of selected plants showed significant antioxidant activities in terms of DPPH scavenging. The BHT was the control for the experiments and the concentration of leaf extract was taken in ml/ml. The DPPH radical scavenging activity of BHT was noted in the range of 42.28 to 58.69% for the concentration of 0.05 to 0.3 ml/ml concentration. The IC_{50} value for control was 1.175 and that of plant extracts was in the range of 2.198 to 2.293 ml/ml. This indicates that the methanolic leaf extracts of these plants have significant antioxidant activity. Capecka *et. al.*,[3] reported the antioxidant activity of fresh and dry Lamiacae herbs and correlated the antioxidant activity with phenolic content. A similar report was given by Erdemoglu *et. al.,*[4]. Mekinic *et. al.,*[14] also presented a correlation study between the phenolic content of the Lamiaceae plant and its antioxidant activity. Ramose da-Silva *et. al.,*[20] gave a compre-hensive review on the antioxidant activity of different Lamiaceae members.

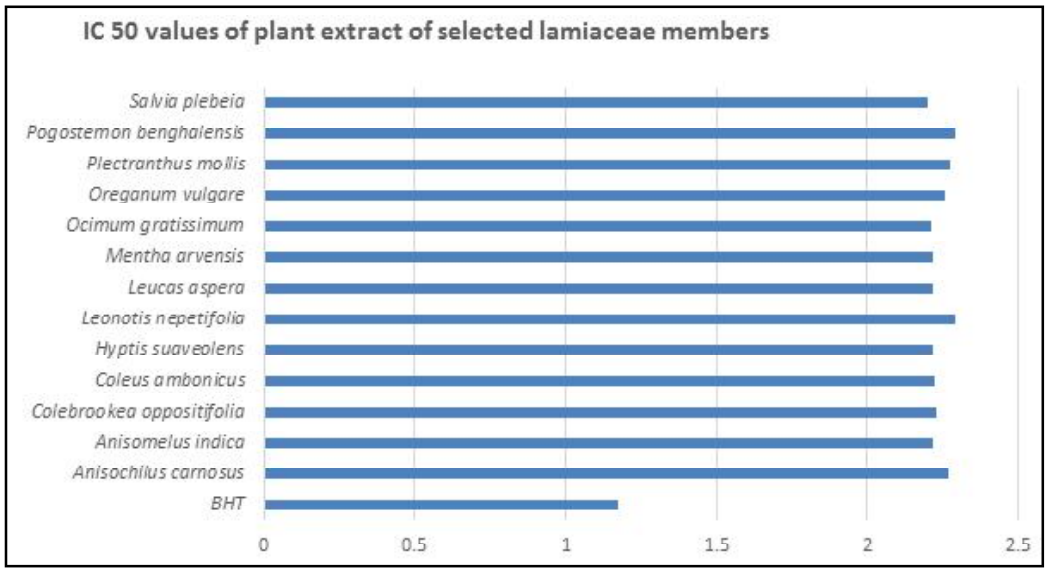


Fig. 3. IC-50 Values of plant leaf extracts of Lamiaceae members for antioxidant activity.

Table-3. Radical scavenging activity of plant extracts of some Lamiaceae members.
DPPH % radical scavenging activity

Conc. of plant Extract (ml/m)	BHT	*Anisochilus carnosus*	*Anisomelus indica*	*Colebrookea oppositifolia*	*Coleus ambonicus*	*Hyptis suaveolens*	*Leonotis nepetifolia*	*Leucas aspera*	*Mentha arvensis*	*Ocimum gratissimum*	*Oreganum vulgare*	*Plectranthus mollis*	*Pogostemon benghalensis*	*Salvia plebeia*
0.05	42.28	12.29	14.27	13.56	05.27	10.25	4.08	14.03	15.02	16.81	12.06	12.16	2.05	13.28
0.1	45.95	36.28	38.42	36.29	36.69	38.28	31.29	36.25	38.42	39.20	29.32	30.15	31.22	38.23
0.2	47.38	42.39	48.35	47.25	44.36	46.23	39.83	40.28	48.35	49.53	38.42	39.28	40.23	43.81
0.3	58.69	52.18	54.25	53.28	52.49	53.76	48.65	53.92	54.23	55.32	52.81	49.22	48.27	57.21
IC_{50}	1.175	2.268	2.218	2.228	2.225	2.216	2.289	2.219	2.215	2.209	2.259	2.275	2.293	2.198

All the plants selected for this study are being used for their medico-botanical applications by the local villagers and tribals of Vidarbha region Maharashtra (India). It was noted that, in some cases, the whole plant is used, in others it may be either stem, leaves, roots, seeds, or a specific combination to cure various ailments. These plants are rich in their phytochemical composition, and the methanolic extract tested showed a high chemical profile. Further, the methanolic leaf extract of each plant showed significant antioxidant activity. The high level of antioxidant activity could be correlated with a significant level of phenolic compounds and terpenes these plants have. These plant extracts could be explored for their pharmacological activities to identify the specific antioxidant dose or efficacy of the plant to develop probable specific ailment-related drug compounds.

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Conflict of Interest:

The authors declare that they have no conflict of interest.

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