

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/245177858>

PLECTRANTHUS AMBOINICUS (LOUR) SPRENG: AN OVERVIEW

Article · December 2010

CITATIONS

11

READS

1,844

6 authors, including:



[Roshan Dhruv Patel](#)

Smt. C. V. Gajera Pharmacy Mahila College, Am...

50 PUBLICATIONS 229 CITATIONS

[SEE PROFILE](#)



[Gulzar Alam](#)

Kailash Institute Of Pharmacy & Management, ...

25 PUBLICATIONS 60 CITATIONS

[SEE PROFILE](#)

Original Article

ISSN 0975-8216

PLECTRANTHUS AMBOINICUS (LOUR) SPRENG: AN OVERVIEW

Roshan P.*, Naveen M., Manjul PS, Gulzar A., Anita S., Sudarshan S.

Affiliated to:

Shree Leuva Patel Trust Pharmacy Mahila College, Amreli, Gujarat



For Email Click Here

ABSTRACT

Plectranthus amboinicus (Lour) Spreng belongs to family Lamiaceae, known as country borage in English. It is large succulent aromatic perennial herb, shrubby below, hispidly villous or tomentose. It is found throughout India, Ceylon and Moluccas. The leaves of the plant are bitter, acrid and were being widely used traditionally for various purposes. The plant has been worked out very well and isolated several chemical constituents and had shown various biological properties. This review is an effort to compile all the information reported on its phytochemical and pharmacological activities. The present review is an attempt to generate interest among the masses regarding its immense potential in preventing and treating the several diseases.

Keywords: *Plectranthus amboinicus*, review, phytochemical, biological properties

INTRODUCTION

Allopathic treatment may either be permanent or temporary depending on the patient's physical damage. Once the patient's health has improved through nutritional methods, sometimes they can be weaned from the synthetic drugs¹. Evaluation of Indian traditional medicine is possible through the proper exploitation and exploration

of wide bio-diversity and great ancient treatises of traditional medicine with the light of modern tools and techniques². Numerous medicinal plants and their formulation are used for disorders in the Ethno medical practices as well as traditional system of medicines in India. Potent activity and long term administration is required for the treatment of chronic diseases. Further, these drugs have various and severe

adverse effect. Therefore naturally originated agents with very little side effects are required to substitute chemical therapeutics. One of such herbal drug for chronic ailments is *Plectranthus amboinicus* Lour. which is widely used traditionally.

- Bengali : Patharkuchi, Amlakuchi, Paterchur
- Gujarati : Ovapana
- Marathi : Pan-Ova, Pathurchur
- Philippines : Oregano
- Singalese : Kapprawalliya
- Tagalog : Suganda

Synonyms: *Coleus amboinicus* Lour.

Coleus aromaticus Benth.³

Family: Lamiaceae

Vernacular Names^{4,5}

- English : Country borage, Indian borage
- Hindi : Patta ajavayin, Patharchur
- Tamil : Karpuravalli
- Kannada : Karpurahalli
- Malayalam : Kannikkurkka, Panikkurkka
- Sanskrit : Pashanabhedhi, Asmantaka, Himsagar
- Telugu : Sugandhavalkam

Distribution

This grassy plant is found or cultivated throughout India, Ceylon and Moluccas⁵. Wild in Rajputana, also cultivated in gardens³.

MACROSCOPICAL FEATURES

Description^{4,6}

A large succulent aromatic perennial herb, shrubby below, hispidly villous or tomentose.

Fig. 1



Fig 2 Leaf of *Plectranthus amboinicus* Lour.

Fig 1 Twig and flowers of *Plectranthus amboinicus* Lour.

Stem

Stems are fleshy with 30-90 cm height.

Leaves

Leaves are 2.5-5 cm long, simple, opposite, petioled, broadly ovate or cordate, crenate, fleshy and very aromatic. Fig. 2

Flowers

Flowers are shortly pedicelled, 3 mm long, pale purplish in dense whorls at distant intervals in a long slender raceme. Upper calyx are lip ovate, acute, membranous, lower acuminate. Corolla are pale purplish, tube short, throat inflated, lips short. Stamens are shortly exerted.

Fruits

Fruits are orbicular or ovoid nutlets. Flowers and fruits during August-November.

Parts Used

Leaves.

MEDICINAL USES

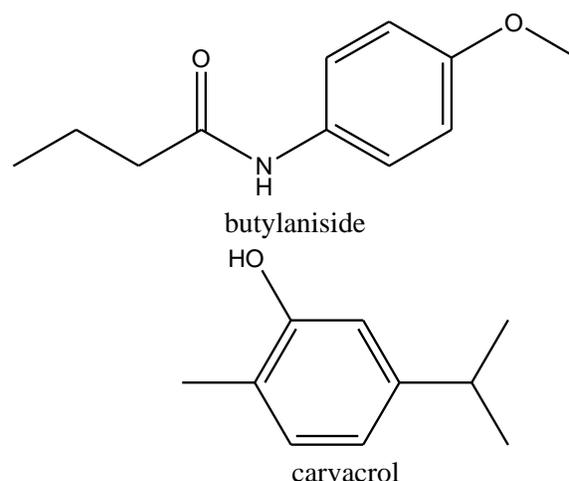
The leaves are bitter, acrid, thermogenic, aromatic, anodyne, appetizing, digestive, carminative, stomachic, anthelmintic, constipating, deodorant, expectorant, lithontriptic, diuretic and liver tonic. They are useful in cephalalgia, otalgia, anorexia, dyspepsia, flatulence, colic, diarrhoea and cholera especially in children, halitosis, convulsions, epilepsy, cough, chronic asthma, hiccough, bochitis, renal and vesical calculi, strangury, hepatopathy, malarial fever, antispasmodic and cathartic⁶.

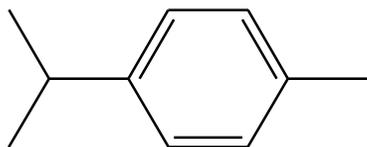
Juice of leaves mixed with sugar acts as a powerful aromatic carminative, given in colic and dyspepsia³. Crushed leaves are used as a local application to the head in headache and to relieve the pain and irritation caused by stings of centipedes. Expressed juice is applied round the orbit to relieve the pain in conjunctivitis⁵. In Malaysia, bruised leaves are applied to burns and their poultice on centipede and scorpion-bites. The leaf juice heals chapped lips and in java it is used to treat cracks at the corners of the mouth⁷.

CHEMICAL CONSTITUENTS

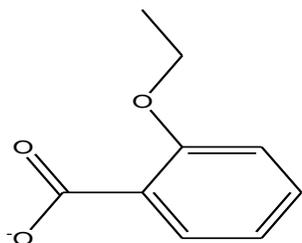
Butylaniside, β -caryophyllene, carvacrol, 1-8-cineole, p-cymene, ethylsalicylate, eugenol,

limonene, myrcene, α and β -pinenes, β -selenene, γ -terpinene, terpinen-4-ol, thymol, verbenone (essential oil), apigenin, chrysoeriol, 5,4-dihydroxy-6,7-dimethoxy-flavone (cirsimaritin), eriodictyol, 6-methoxy-genkawanin, luteolin, quercetin, salvigenin, taxifolin, oxaloacetic acid, crategolic, euscaphic, 2 α -3 α -dihydro-olean-12-en-28-oic, pomolic, oleanolic, tormentic, 2 α ,3 α ,19 α ,23-tetrahydroxyurs-12-en-28-oic, ursolic acids, β -sitosterol- β -D-glucoside isolated from the leaves⁸.

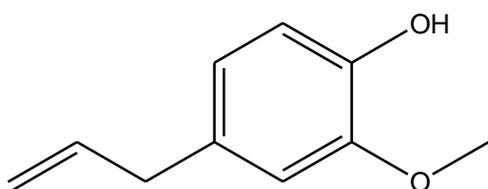




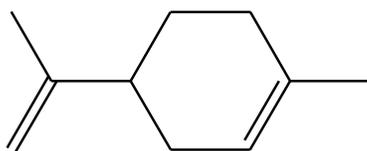
p-cymene



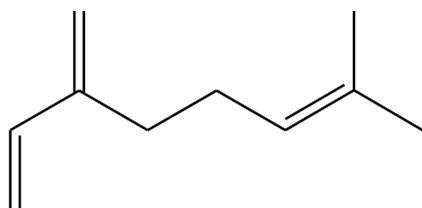
ethylsalicylate



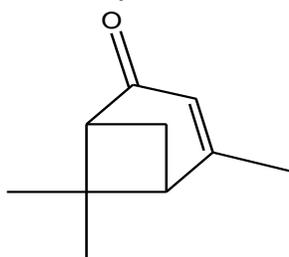
eugenol



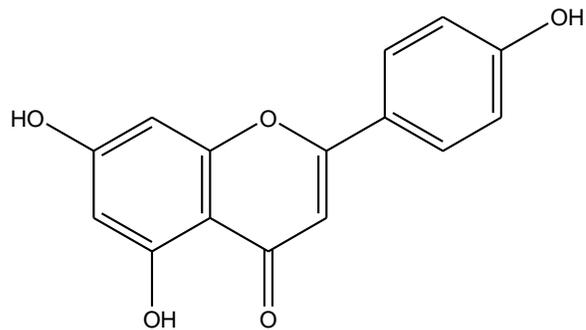
limonene



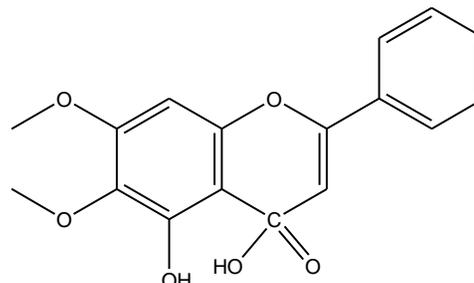
myrcene



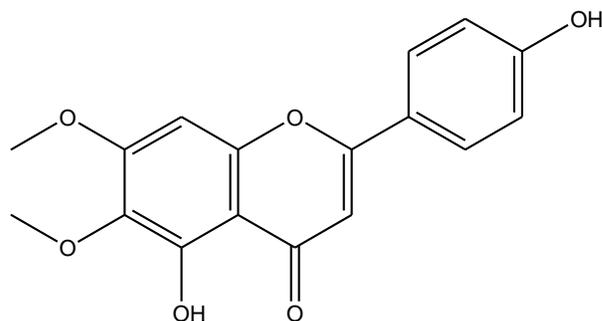
verbenone



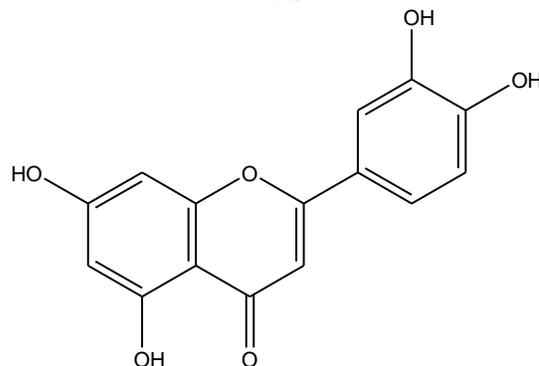
apigenin



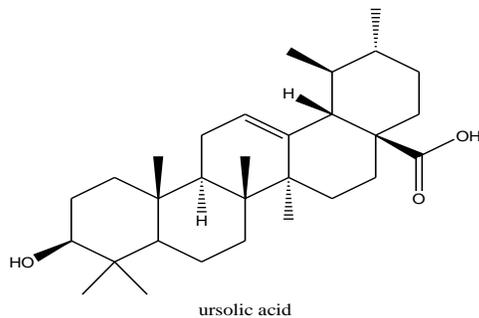
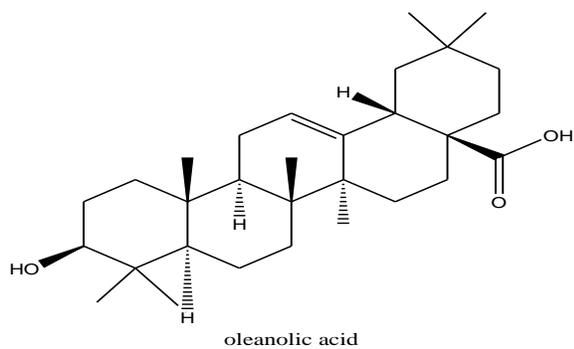
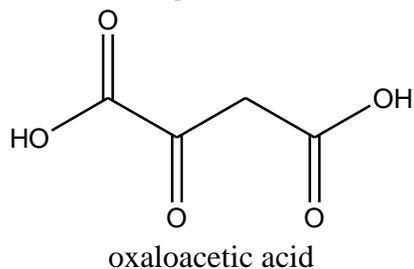
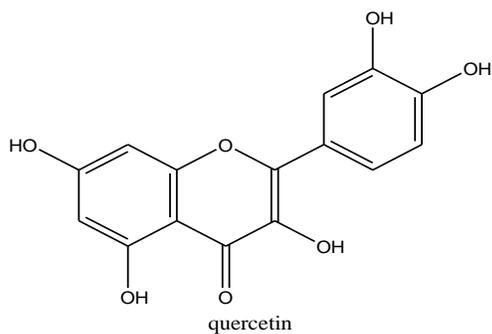
5,4-dihydroxy-6,7-dimethoxy-flavone



6-methoxy-genkwanin



luteolin



PHARMACOGNOSY

Brindha P. *et al.*, (1991) presented the pharmacognostic, exomorphology, histomorphology and physico-chemical evaluation of the leaf and stem of *Coleus aromaticus*⁹. Kaliappan ND and Viswanathan PK *et al.*, (2008) carried out the micro

morphological studies on the leaves of *Plectranthus amboinicus*¹⁰.

PHYTOCHEMISTRY

Brieskorn CH and Reidel W (1977) isolated eight triterpene acids from the leaves of the South - American lamiaceae *Coleus amboinicus* Loureiro. 2,3-Dihydroxylean-12-en-28-oic acid, 2,3,19-trihydroxyurs-12-en-28-oic acid and 2,3,19,23-tetrahydroxyurs-12-en-28-oic acid were found first time in lamiaceae¹¹.

Baslas RK and Kumar P (1981) reported that the oil obtained by steam distillation (0.04-0.05%), has been found to contain terpinolene (3.75%), α -pinene (3.20%), β -pinene (2.50%), β -caryophyllene (4.20%), methyl eugenol (2.10%), thymol (41.3%), 1,8-cineole (5.45%), eugenol (4.40%), carvacrol (13.25%) and β -phellandrene (1.90%)¹². Bos R and Hendriks FH (1983)

studied the composition of essential oil in the leaves of *Coleus aromaticus* Benthum and their importance as a component of species antiaphthosae¹³. Malik MS *et al.*, (1985) studied on essential oil of the *Coleus aromaticus* plant¹⁴. Haque IU (1988) detected fifteen components in the essential oil (0.1%) obtained from dry steam distillation of the fresh stalk and leaves of

Coleus aromaticus. Thymol (79.6%) was shown to be the principal component of the oil¹⁵. Pino J *et al.*, (1989) investigated the essential oil of *Coleus amboinicus* Lour. by means of LSC, GLC and GC-MS and 20 components were identified, including 13 terpene hydrocarbons and 7 oxygenated compounds. The oils contained about 64% carvacrol¹⁶. Pino JA *et al.*, (1996) isolated volatile compounds from *Coleus aromaticus* leaf by steam distillation, hexane extraction and super critical CO₂ extraction and identified 26 components by GC/MS¹⁷. Mallavarapu GR *et al.*, (1999) analyzed the essential oils of *Coleus aromaticus* distilled in different seasons by capillary GC and GC/MS. The oils were found to contain carvacrol, p-cymene and gamma-terpinene as major constituents. The oil produced in September was found to contain higher contents of carvacrol and beta-caryophyllene and oxygenated constituents than the oil produced in May¹⁸. Ragasa CY *et al.*, (1999) reported that the air dried leaves of *Coleus amboinicus* afforded three flavones: salvigenin, crisimaritin and chrysoeriol by silica gel chromatography. Their structures were elucidated by extensive 1D and 2D NMR and UV spectroscopy. Antimicrobial

assay on salvigenin and crisimaritin showed low activities against the microorganisms tested¹⁹. Singh G *et al.*, (2002) investigated the leaf essential oil of *Coleus aromaticus* by GC and GC-MS techniques which indicated the presence of six components, accounting for 97 percent of the total oil²⁰. Kumaran A and Karunakaran RJ (2007) used an activity directed fractionation and purification process to identify the DPPH (1,1-diphenyl-2-picrylhydrazyl) free radical scavenging components of *Coleus aromaticus* Benth. Rosmarinic acid was found as a major component and principally responsible for the radical scavenging activity of *Coleus aromaticus*²¹.

PHARMACOLOGY

Vera R *et al.*, (1992) investigated essential oils of *Plectranthus amboinicus* by GLS & MS. Juice of its leaves is used for curing wounds and an infusion is said to possess anti-influenza properties²². Baskar R *et al.*, (1992) administered *Coleus aromaticus* leaf juice (at the rate of 1ml/rat/day) for 10-30 days in experimental urolithiatic rats. Reduction in the deposition of Ca and oxalate in the kidney tissue has been reported²³. Buzenego MT and Perez-

saad H (1999) reported antiepileptic effect of *Plectranthus amboinicus* (Lour) Spreng²⁴. Annapurani S *et al.*, (1999) exhibited significant antitumour and antimutagenic activities of *Coleus aromaticus*, *Ocimum sanctum* and *Aegle marmelos* and estimated polyphenol content in each²⁵. Santosa CM (2002) reported that *Coleus amboinicus* leaves exhibited increasing milk secretion of lactating animals and seemed to be superior to other treatment groups on milk secretion and also containing iron and potassium composition²⁶. Shyama Prasad S *et al.*, (2002) investigated the anticlastogenic potency of the ethanolic extract of *Coleus aromaticus* and the results indicate the protective effect against cyclophosphamide and mitomycin-c induced cytogenetic damage²⁷. Perez SH *et al.*, (2003) reported neuropharmacological profile of *Plectranthus amboinicus* (Lour) Spreng²⁸. Rao BS *et al.*, (2006) elucidated in vitro free radical scavenging potential and inhibition of lipid peroxidation by *Coleus aromaticus* hydrochloric extract (CAE). Anti-clastogenic and radioprotective potential of CAE were studied using micronucleus assay after irradiating Chinese hamster fibroblast (V79) cells²⁹. Kumaran A and Karunakaran RJ (2006) investigated the antioxidant potency of freeze-dried aqueous extract of *Coleus aromaticus*, employing various established in vitro models³⁰. Kumar A *et al.*, (2007) studied mast cell stabilization property of aqueous and hydrochloric leaf extract of *Coleus aromaticus* in rat peritoneal mast cells³¹. Chang JM *et al.*, (2007) investigated therapeutic efficacy of *Plectranthus amboinicus* in treating rheumatoid arthritis using collagen-induced arthritis in animal model³². Hole RC (2008) studied that aqueous extracts of fresh leaves of *Coleus amboinicus* Lour. parent, as well as tissue culture-raised plants showed a dose dependent positive inotropic effect on isolated frog heart³³. Periyanyagam K *et al.*, (2008) has performed in vivo study of aqueous extract of leaves of *Plectranthus amboinicus* on Plasmodium berghei yoelii³⁴. Gurgel AP *et al.*, (2009) evaluated the anti-inflammatory and antitumor activities of the hydroalcoholic extract from leaves of *Plectranthus amboinicus* (Lour.) Spreng³⁵. Patel R *et al.*, (2010) evaluated the diuretic properties of ethanolic and aqueous extracts of leaves of *Plectranthus amboinicus* in male albino rats³⁶. Palani S *et al.*, (2010) investigated the nephroprotective, diuretic and

antioxidant activities of the ethanol extract of *Plectranthus amboinicus* at two dose 250 and 500 mg/kg bw on APAP-induced toxicity in rats³⁷.

MICROBIOLOGY

Rao A *et al.*, (1991) reported that oil isolated from the leaves of *Coleus amboinicus* exhibited varying degree of antimicrobial activity against a number of pathogenic and non-pathogenic fungi and bacteria³⁸. Prudent D *et al.*, (1995) analyzed the essential oil of *Coleus aromaticus* for its bacteriostatic and fungistatic properties³⁹. Ruiz AR *et al.*, (1996) carried out a screening for genotoxic activity in aqueous or alcoholic extracts from 13 medicinal plants used as folk medicine in Cuba along with *Plectranthus amboinicus*⁴⁰. Deena MJ *et al.*, (2002) reported antimicrobial screening of essential oils of *Coleus aromaticus* and *Coleus zeyla*⁴¹. Perumal G *et al.*, (2004) tested ethanolic extract of nine medicinal plants parts along with *Coleus aromaticus* (leaves) for antifungal activity against *Aspergillus flavus*, *A. terreus* and *Mucor* species. The extract in different concentrations exhibited good fungicidal activity⁴². Uawonggul N *et al.*, (2006) screened the aqueous extracts of

64 plant species along with *Plectranthus amboinicus* for their activity against fibroblast cell lysis after *Heterometrus laoticus* scorpion venom treatment⁴³. Murthy PS *et al.*, (2009) investigated *Plectranthus amboinicus* for antifungal activity through agar well diffusion assay⁴⁴.

TOXICITY STUDIES

Parra AL *et al.*, (2001) determined the median lethal concentrations (LD50 value) of 20 plant extracts along with *Plectranthus amboinicus* using *Artemia salina* (tested at three concentrations: 10, 100 and 1000 µg/ml for each extract). Good correlation was found between in vivo and in vitro test ($r = 0.85$, $P < 0.05$)⁴⁵. Jose MA *et al.*, (2005) have done the LD50 using OECD guideline for testing of chemicals revised draft guideline 423. The one tenth of the LD50 500mg/kg was chosen as a dose for the further study. The urine and histopathological results clearly revealed the antilithiotic activity of *Plectranthus amboinicus* particularly of calcium oxalate origin⁴⁶.

MISCELLANEOUS STUDIES

Baslas RK and Kumar P (1981) reviewed the chemical composition, medicinal uses and biological activities of *Coleus aquaticus*, *C. amboinicus*, *C. barbalus*, *C. blumei*, *C. forskohlii*, and *C. somaliensis*⁴⁷. Kuebel KR and Tucker AO (1988) discussed identification, cultivation, chemistry and uses of nine Vietnamese herbs, hitherto rare or unknown in the united states viz *Plectranthus amboinicus*⁴⁸. Morton JF (1992) reviewed origin, distribution, medicinal uses and phytochemical work of *Coleus amboinicus*⁴⁹. Morallo RB *et al.*, (1992) evaluated the biological activity of 18 medicinal plants along with *Coleus amboinicus*. It was found that *Coleus amboinicus* did not exhibited pronounced insecticidal activity⁵⁰. Kathiresan RM (2000) reviewed the allelopathic potential of native plants for use as an alternative bio-control tactic. Dried powder of the leaves of *Omanvalli Coleus amboinicus* L. at 40g l⁻¹ as a water suspension killed water hyacinth with 24 h reducing the fresh weight by 80.72% and dry weight by 75.63% within one week⁵¹. Gupta S *et al.*, (2004) analysed nutrient and antinutrient content of 13 locally available underutilized green leafy vegetables along with *Coleus aromaticus* Benth⁵².

CONCLUSION

Considering the easy availability of *Plectranthus amboinicus* in our country and leaves of the plant possess a wide range of biological properties, it seems that still there is a scope for scientific studies to fully exploit its medicinal properties to support traditional claims as well as, exploring some new and promising leads. The pharmacological studies so far have mostly been performed for volatile principle of plant. In future study, the isolated principle of extracts of *Plectranthus amboinicus* needs to be evaluated in scientific manner. It could be concluded that *P. amboinicus* is a rich source of compounds, interesting chemical structures and various biological active products.

References:

1. Biswas PK. Encyclopedia of Medicinal Plants. Vol.1. 1st ed. Dominant Publishers and Distributors, New Delhi, India; 2006. p. 11-14.
2. Mukherjee PK, Quality Control of Herbal Drugs. 1st ed. Business Horizons, New Delhi, India; 2002. p. 2, 29-30.

3. Chopra RN, Nayar SL and Chopra IC. Glossary of Indian Medicinal Plants. C.S.I.R. Publications, New Delhi, India; 1999. p. 74.
4. Kirtikar KR and Basu BD. Indian Medicinal Plants. Vol.3. International Book Distributors, Dehradun, India; 1999. p. 1970-71.
5. Nadkarni AK. Indian Materia Medica. Vol.1. 3rd ed. Popular Prakashan, Bombay, India; 2002. p. 371-72.
6. Warier PK and Nambier VP. Indian Medicinal Plants: A compendium of 500 species. Vol.4. Orient Longman Limited, Chennai; 1996. p. 315.
7. Anonymous. The Wealth of India: A Dictionary of Indian Raw Materials & Industrials Products. Vol.2: Cl-Cy. C.S.I.R. Publications, New Delhi, India; 1998. p. 154.
8. Chatterjee A. and Pakrashi S.C. The Treatise of Indian Medicinal Plants. Vol.5. Council of Industrial and Scientific Research, New Delhi, India; 2001. p. 8-9.
9. Brindha P, Sasikala E, Pappa M, Bhima rao R and Kundu AB. Pharmacognostic studies on *Coleus aromaticus* Benth. (Indian Borage). Bulletin of Medico-Ethnobotanical Research. 1991; 12(1-2): 17-31.
10. Kaliappan ND and Viswanathan PK. Pharmacognostical studies on the leaves of *Plectranthus amboinicus* (Lour.) Spreng. Int J Green Pharm. 2008; 2: 182-84.
11. Brieskorn CH and Riedel W. Triterpenic acids from *Coleus amboinicus* Loureiro. Arch Pharm (Weinheim). 1977; 310(11): 910-16.
12. Baslas RK and Kumar P. Chemical examination of essential oil of *Coleus aromaticus* Benth. Journal of Indian Chem. Soc. 1981; 58(1): 103-04.
13. Bos R and Hendriks FH. The compositions of essential oil in the leaves of *Coleus aromaticus* Bentham and their importance as a component of species antiaphthosae. Pharm Weekly Sci. 1983; 26: 129-30.
14. Malik MS, Ahmed R, Khan SA and Bhatti MK. Studies on essential oil of the *Coleus aromaticus* plant. Pak. J. Sci. Ind. Res. 1985; 28: 10-12.
15. Haque IU. Analysis of volatile constituents of *Coleus aromaticus*. Journal of the Chem. Society of Pakistan. 1988; 10(3): 369-71.
16. Pino J, Rosado A and Borges P. Volatile components in the essential oil of wild oregano (*Coleus amboinicus* Lour.). Food / Nahrung. 1989; 34(9): 819-23.

17. Pino JA, Garcia J and Martinez MA. Comparative chemical composition of the volatiles of *Coleus aromaticus* produced by steam distillation, solvent extraction and supercritical carbon dioxide extraction. *Journal of Essential Oil Research*. 1996; 8(4): 373-75.
18. Mallavarapu GR, Rao L and Ramesh S. Essential oil of *Coleus aromaticus* Benth, from India. *J. Esst. Oil Research*. 1999; 11: 742-44.
19. Ragasa CY, Pendon J, Sangalang V and Rideout JA. Antimicrobial flavones from *Coleus amboinicus*. *Philippine Journal of Science*. 1999; 128(4): 347-51.
20. Singh G, Singh OP, Prasad YR, de Lampasona MP and Catalan C. Studies on essential oils, Part 33: chemical and insecticidal investigations on leaf oil of *Coleus amboinicus* Lour. *Flavour and Fragrance Journal*. 2002; 17: 440-42.
21. Kumaran A and Karunakaran RJ. Activity guided isolation and identification of free radical scavenging components from an aqueous extract of *Coleus aromaticus*. *Food Chemistry*. 2007; 100: 356-61.
22. Vera R, Mondon JM and Pieri buttesti JC. Some Medicinal Plants of reunion, 7th Asian Symposium on Medicinal Plants, Spices and other Natural Products, (ASOMPS VII), Manila. 1992.
23. Baskar R, Varalaksmi P and Amsaveni. Changes in tissue enzymes produced by *Coleus aromaticus* experimental Urolithiasis. *Indian Drugs*. 1992; 29(6): 254-58.
24. Buznego MT and Perez-Saad H. Antiepileptic effect of *Plectranthus amboinicus* (Lour.) Spreng. *Rev. Neurol*. 1999; 29: 229-32.
25. Annapurani S. and Priya R. Antimutagenic, antitumorigenic and antigenotoxic effects of polyphenol extracts of selected medicinal plants. *Indian Journal of Nutrition and Dietetics*. 1999; 36(10): 431-35.
26. Santosa CM. The effect of 'bangun-bangun' leaves (*Coleus amboinicus* L.) consumption of the potency of milk secretion and its composition of lactating mothers. *Indonesian Journal of Pharmacy*. 2002; 13(3): 133-39.
27. Shyama Prasad S, Naik P and Vijayalaxmi KK. Efficiency of *Coleus aromaticus* extract in modifying cyclophosphamide and mitomycin-C induced clastogenicity in mouse bone marrow cells. *Journal of Experimental Biology*. 2002; 40(9): 1020-25.

28. Perez SH, Buznego MT, Lianio VM, Perez FM and Menedex R. Neuropharmacological profile of *Plectranthus amboinicus* (Lour) Spreng. (Indian borage). Rev. Neurol. 2003; 36: 98-99.
29. Rao BS, Shanbhoge R, Upadhy D, Iagetiya GC, Adiga SK, Kumar P, Guruprasad K, and Gayathri P. Antioxidant, anticlastogenic and radioprotective effect of *Coleus aromaticus* on Chinese hamster fibroblast cells (V79) exposed to gamma radiation. Mutagenesis. 2006; 21(4): 237-42.
30. Kumaran A and Karunakaran Joel R. Antioxidant and free radical scavenging activity of an aqueous extract of *Coleus aromaticus*. Food Chemistry. 2006; 97: 109-14.
31. Kumar A, Elango K, Markanday S, Undhad CV, Kotadiya AV, Savaliya BM, Vyas DN and Datta D. Mast cell stabilization property of *Coleus aromaticus* leaf extract in rat peritoneal mast cells. Indian Journal of Pharmacology. 2007; 39(2): 119-20.
32. Chang JM, Cheng CM, Hung LM, Chung YS and Wu RY. Potential use of *Plectranthus amboinicus* in the treatment of rheumatoid arthritis. Evid Based Complement Alternat Med. 2007.
33. Hole RC, Juvekar AR, Roja G, Eapen S and D'Souza SF. Positive inotropic effect of the leaf extracts of parent and tissue culture plants of *Coleus amboinicus* on an isolated perfused frog heart preparation. Food Chemistry. 2009; 114(1): 139-41.
34. Periyannayagam K, Nirmala Devi K, Suseela L, Uma A and Ismail M. In vivo antimalarial activity of leaves of *Plectranthus amboinicus* (Lour) Spreng on Plasmodium berghei yoelii. J Commun Dis. 2008; 40(2): 121-25.
35. Gurgel AP, da Silva JG, Grangeiro AR, Oliveira DC, Lima CM, da Silva AC, Oliveira RA, Souza IA. In vivo study of the anti-inflammatory and antitumor activities of leaves of *Plectranthus amboinicus* (Lour.) Spreng (Lamiaceae). J Ethnopharmacol. 2009; 125(2): 361-63.
36. Patel R, Mahobia N, Gendle R, Kaushik B and Singh S. Diuretic activity of leaves of *Plectranthus amboinicus* in male albino rats. Pharmacog Res. 2010; 2: 86-88.
37. Palani S, Raja S, Naresh R and Kumar BS. Evaluation of nephroprotective, diuretic and antioxidant activities of *Plectranthus amboinicus* on acetaminophen-induced

- nephrotoxic rats. *Toxicol Mech Methods*. 2010; 20(4): 213-21.
38. Rao A, GSJG, Baby P and Prasad RY. Leaf oil of *Coleus amboinicus* Lour: the in vitro anti-microbial studies. *Perfume and Kosmetik*. 1991; 72(11): 744-45.
39. Prudent D, Perineau F, Bessiere JM, Michel GM and Baccou JC. Analysis of the essential oil of wild oregano from Martinique (*Coleus aromaticus* Benth.), evaluation of its bacteriostatic and fungistatic properties. *J. Esst. Oil Res*. 1995; 7: 165-73.
40. Ruiz AR, De la Torre RA, Alonso N, Villaescusa A, Betancourt J and Vizoso A. Screening of medicinal plants for induction of somatic segregation activity in *Aspergillus nidulans*. *Journal of Ethnopharmacology*. 1996; 52(3): 123-27.
41. Deena MJ, Sreeranjini K and Thoppil JE. Antimicrobial screening of essential oils of *Coleus aromaticus* and *Coleus zeyla*. *Ind. J. Aromatherapy*. 2002; 12: 105-07.
42. Perumal G, Subramanyam C, Natrajan D, Srinivasan K, Mohanasundari C and Prabakar K. Antifungal activities of traditional medicinal plant extracts-A preliminary survey. *Journal of Phytological Research*. 2004; 17(1): 81-83.
43. Uawonggul N, Chaveerach A, Thammasirirak S, Arkaravichien T, Chuahan C and Daduang S. Screening of plants acting against *Heterometrus laoticus* scorpion venom activity on fibroblast cell lysis. *Journal of Ethnopharmacology*. 2006; 103(2): 201-07.
44. Murthy PS, Ramalakshmi K. and Srinivas P. Fungitoxic activity of Indian borage (*Plectranthus amboinicus*) volatiles. *Food Chemistry*. 2009; 114(3): 1014-18.
45. Parra AL, Yhebra RS, Sardinas IG and Buela LI. Comparative study of the assay of *Artemia salina* L. and the estimate of the medium lethal dose (LD50 value) in mice, to determine oral acute toxicity of plant extracts. *Phytomedicine*. 2001; 8(5): 395-400.
46. Jose MA, Ibrahim and Janardhanan S. Modulatory effect of *Plectranthus amboinicus* Lour. on ethylene glycol induced nephrolithiasis in rats. *Indian Journal of Pharmacology*. 2005; 37(1): 43-44.
47. Baslas RK and Kumar P. Phytochemical studies of the plants of *Coleus* genera. *Herb Hung*. 1981; 20(1-2): 213-21.
48. Kuebel KR and Tucker AO. Vietnamese culinary herbs in the United States. *Economic Botany*. 1988; 42(3): 413-19.

49. Morton JF. Country borage (*Coleus amboinicus* Lour.), a potent flavouring and medicinal plant. *Journal of Herbs, Spices and Medicinal plants*. 1992; 1(1&2): 55-56.
50. Morallo RB, Maini HA, Dayrit F and Quintana E. Biocidal action of some medicinal plants to insects, 7th Asian Symposium on Medicinal Plants, Spices and other Natural Products, (ASOMPS VII). Manila. 1992.
51. Kathiresan RM. Allelopathic potential of native plants against water hyacinth. *Crop Protection*. 2000; 19: 705-08.
52. Gupta S, Jyothi Lakshmi A, Manjunath MN and Prakash Jamuna. Analysis of nutrient and antinutrient content of under utilized green leafy vegetables. *LWT*. 2005; 38: 339-45.