

TWO DAYS NATIONAL LEVEL CONFERENCE

ON

**ROLE OF
PHYTOCHEMICALS AND
ADVANCED MATERIALS IN
CANCER PREVENTION
AND RESEARCH**

Sponsored By



TNSCHE

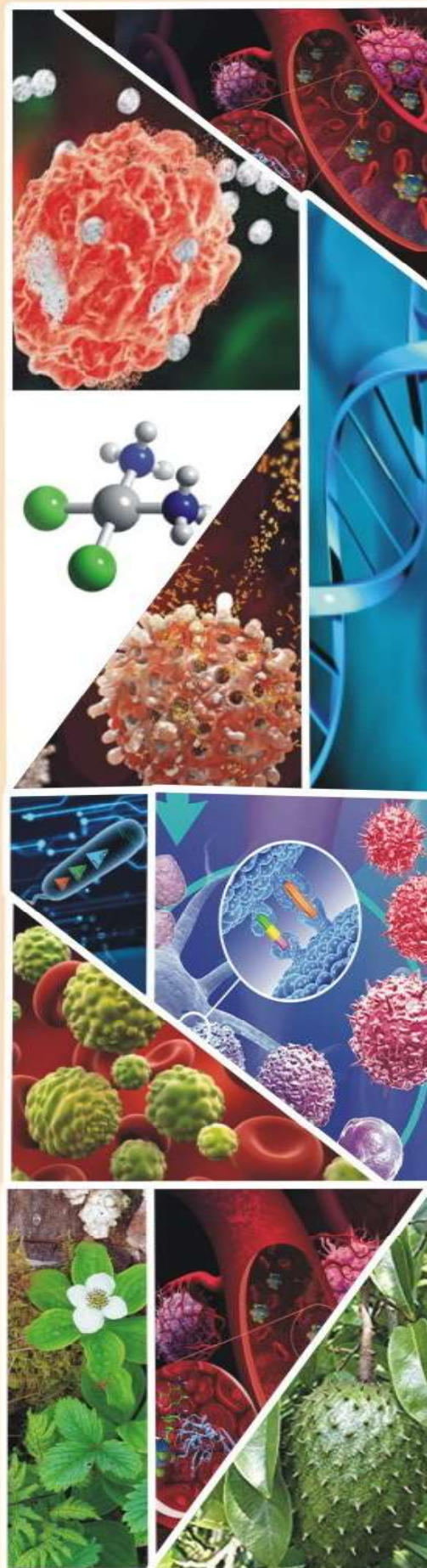


NGM COLLEGE

**Chief Editor
Dr.K.Poonkodi**

**Joint Editors
Ms.K.Vimaladevi
Ms.R.Mini
Dr.V.Prabhu
Ms.M.Anusuya**

**PG DEPARTMENT OF CHEMISTRY
NGM COLLEGE, POLLACHI**



21.	A REVIEW ON COPPER FERRITE AND METAL DOPED COPPER FERRITE MATERIALS: SYNTHESIS AND ITS MAGNETIC PROPERTIES <i>A.NAGAVENI, M.ANUSUYA AND E.JAYANTHI</i>	115
22.	PHARMACOLOGICAL ACTIVITIES OF <i>Anisomeles malabarica</i> - A REVIEW <i>NARMADA B and MINI R</i>	119
23.	A SHORT REVIEW ON PHYTOPHARMACOLOGICAL STUDIES ON LOTUS FLOWER AND HIBISCUS FLOWER <i>VELLIANGIRI PRABHU and PRIYA</i>	126
24.	AN OVERVIEW ON THE ROLE OF ZINC OXIDE AND CERIUM OXIDE IN AGRICULTURE <i>M.PRIYA</i>	131
25.	PHYTOCHEMICAL ANALYSIS OF <i>Barleria prionitis</i> BY GCMS <i>K.VIMALADEVI and J.PRIYADHARSINI</i>	135
26.	EVALUATION of CHEMICAL CONSTITUENTS and BIOLOGICAL ACTIVITY of <i>Lantana camara</i> LEAVES ESSENTIAL OIL <i>Ms. MINI. R, Ms. K.VIMALADEVI and VASUKI.A</i>	139
27.	GREEN SYNTHESIS AND CHARACTERIZATION OF TiO ₂ /SiO ₂ /Ag NANOPARTICLES FROM <i>Cardiospermum halicacabum</i> LEAF EXTRACT <i>RAJESWARI SIVARAJ, VINOTHINI S, PERIYANAYAKAM N and VENCKATESH R</i>	145
28.	ANTICANCER POTENTIAL OF ANTHOCYANINS - AN UPDATED REVIEW <i>R.RAKKIMUTHU, P.SATHISHKUMAR, A.M. ANANDAKUMAR AND D.SOWMIYA</i>	150
29.	SYNTHESIS AND CORROSION INHIBITIVE STUDY OF BENZODIAZEPINE DERIVATIVE AGAINST MILD STEEL CORROSION IN 1M HCL <i>T.SASIKALA</i>	154
30.	IN VITRO CYTOTOXIC ACTIVITY BETWEEN METHANOL EXTRACT AND ACTIVITY GUIDED FRACTION OF ACACIA CAESIA (L.) WILLD. <i>P. SATHISHKUMAR, R. RAKKIMUTHU, A.M. ANANDAKUMAR AND D. SOWMIYA</i>	155
31.	LOW DENSE SiO ₂ NANO PARTICLES: SYNTHESIS AND CHARACTERIZATION <i>MANOJKUMAR.K, KANDEEBAN RAJAGOPALAN, S. VISHALEE and K. SAMINATHAN</i>	160

PHARMACOLOGICAL ACTIVITIES OF *Anisomeles malabarica* - AN REVIEW

NARMADA B¹ and MINI R*

*Assistant Professor, ¹II-MSc Chemistry, Post Graduate Department of Chemistry
Nallamuthu Gounder Mahalingam College, Pollachi, Coimbatore, India-642001

ABSTRACT

In the present review, an attempt has been made to congregate the phytochemical, ethno medicinal, pharmacological information on *Anisomeles malabarica* a medicinal herb used in the indigenous system of medicine. Medicinal plant extracts and their constituents have proved to be biodegradable and their activities were similar to those of the standard drugs. Natural products especially from plant sources, including species have been investigated for their characteristics and health benefits. *Anisomeles malabarica* is a medicinal plant has been used as a folkloric medicine. *Anisomeles malabarica* belongs to family Lamiaceae and is found throughout tropical and subtropical regions of India and it acts as an antimicrobial drug and treatment of various kinds of diseases like amentia, anorexia, cancer, allergy, inflammatory disease and methanol extract of *Anisomeles malaborica* showed inhibitory activity for gram positive and negative bacteria, viruses.

Keywords: Medicinal properties, *Anisomeles malabarica*, Pharmacological activities.

INTRODUCTION

In last 5 years, research on more than 13,000 plants has been conducted. A lot of evidence has collected to demonstrate huge potential of the medicinal plants employed in traditional system. In recent years, research on medicinal plants has increased.¹ World Health Organization (WHO) define medicinal plants as a herbal preparation which is produced by introducing plant materials into various of process which include extraction, fractionation, purification, concentration or other physical or biological processes which may be produced for basis for herbal product or for the immediate consumption.² About 80% of people living in rural area of India are depend on medicinal plants. Overall, 80% of the world's population has dependability in traditional medicine, chiefly based on plant drugs for their primary healthcare³ based on the information extracted from the articles, the review was done to look into anticancer, antiviral, ant diabetics, antifungal and also the phytochemical constituents that are present in the medical plants. Phytochemical constituent are the compounds that present in the plant where it lead to the pharmacological properties of the plant. Researchers proved the practice of utilizing the medicinal plants for treating the diseases in immemorial time. In this review, medicinal plant related to anticancer, anti-inflammatory, antioxidant and its phytochemical that are composed by the medicinal plant *Anisomeles malabarica* were reviewed.

PLANT INTRODUCTION

The Asian - Australian genus *Anisomeles* belongs to the tribe lamiaceae of the sub family lamiodeae.⁴ *Anisomeles malabarica* is a potent drug used in ayurveda and siddha systems of medicine. *Anisomeles malabarica* is the genuine source of sprikka. It is a medicinal plant that has been used as a folkloric medicine. It is found throughout the tropical and subtropical regions. It is a shrub with tomentose, tetragonal stem. Leaves are simple, opposite, thick, aromatic and woolly. Flowers are purple in dense whorls of interrupted spikes. Stem and leaves are covered with woolly soft and white hairs⁵ it acts as

a medicinal drug it having some acidic properties and is used for treatment of various kinds of diseases like amentia, anorexia, cancer, allergy, inflammatory disease. It is commonly known as **Aruvaachadachi**. It is erect shrub commonly known as **Malabarcatmint**.⁶



Figure -1: *Anisomeles malabarica* plant

PHYTOCHEMICAL STUDIES

Phytochemical studies of *A. malabarica* have shown the presence of anisomelic acid, anisomelolide, 2-acetoxymalabaric acid, anisomelyl acetate anisomelin, betulinic acid, β sitosterol, Citral, geranic acid, malabaric acid, ovatodiolide, and triterpenebetulinic acid.⁷

Health Benefits

Anisomeles malabarica useful in halitosis, epilepsy, hysteria, amentia, anorexia, dyspepsia, colic, flatulence, intestinal worms, fever arising from teething children, intermittent fever, gout, swelling and diarrhea.⁸ It is used to treat amentia, anorexia, fevers, swellings, rheumatism.⁹ The herb is reported to possess anticancer, allergenic, anthelmintic, antiallergic, antianaphylactic, anti-bacterial, anticarcinomic, antiedemic, antihistaminic, anti-inflammatory, ant leukemic, antinociceptive, antiplasmodial, antiseptic and antiperoticproperties.¹⁰ Flavanoids have been reported to expert multiple biological effects such as anti-inflammatory, anti-allergic, anti-viral and anti-cancer activities. The one of the chemicals produced by plants are the alkaloids and their amazing effect on humans has to the development of powerful pain killer medicine.¹¹

EXPERIMENTAL AND CLINICAL STUDIES

All over the world scientific research is getting momentum to evaluate the pharmacological activities and medicinal uses of *Anisomeles malabarica* against different diseases. On the basis of various experimental and clinical researches, the following pharmacological activities or medicinal properties of *A.malabarica* have been reported.

ANTIOXIDANT ACTIVITY

The members of the genus *Anisomeles malabarica* have potent antioxidant properties.¹² Among different plants tested for antioxidant properties *Anisomeles malabarica* exhibited strong antioxidant characteristics, when compared to other plants.¹³ The ethyl acetate extract of leaves from *A.malabarica* was tested for antioxidant property by using Free radical scavenging assays such as hydroxyl, superoxide anion radicals, 2,2-diphenyl-1-picrylhydrazyl (DPPH) and 2,2'-azinobis-(3-ethylenzothiazoline- 6-sulfonic acid) (ABTS) radical scavenging. They found that the extract effectively scavenged hydroxyl and superoxide anion, DPPH and ABTS radicals. All the concentrations of leaf

extract have prominent free radical scavenging and antioxidant power and the preventive effects were in a dose-dependent manner.¹⁴ The methanolic extract of whole plant of *A. malabarica* contains significant quantities of the antioxidant principles compared to the other solvent extracts.¹⁵ The antioxidant activity of whole plant *A. malabarica* was assessed by hydroxyl radical scavenging activity, FRAP assay, nitric oxide radical scavenging activities. The significant free radical scavenging activity was found in methanolic extract than that of standard. Prominent in vitro antioxidant potential of ethanolic extract of *A. malabarica* was reported.¹⁶ In vitro antioxidant assay by DPPH free radical scavenging activity and reducing ability with leaf extracts of *A. malabarica* was evaluated. It was found that methanol and hexane extracts showed good potency of antioxidant property. Methanol and hexane leaf extracts of *A. malabarica* showed good potency of antioxidant activity. Comparative study of these crude extracts revealed that methanol extract was more effective than hexane. Methanol extract showed very good antiradical activity and reductive ability.¹⁷

ANTIBACTERIAL ACTIVITY

Among petroleum ether, ethyl acetate, methanol extracts of *A. malabarica* tested for Antimicrobial efficacy against gram positive and gram negative bacterial and fungal organisms, the ethanolic extract exhibited maximum antibacterial and anti-fungal activity when compared with other two extracts. The synthesized silver nanoparticles from leaf and boiled leaf extracts of *A. malabarica* showed prominent growth inhibition on *Pseudomonas* species.¹⁸ The *invitro* antimicrobial activity of *A. malabarica* was performed by agar well diffusion method against the clinically important multi drug resistant bacterial strains *S. aureus*, *B. subtilis* and *K. pneumoniae* with the concentration of extracts ranging from 25 to 75 μ L; it was found that the activity was varied with depending upon the concentration.¹⁹ The ethanol, methanol, petroleum ether and aqueous extract from the leaf and boiled leaf of *A. malabarica* were investigated for antibacterial property. In polar studies the maximum zone of inhibition were found against *S. aureus*. Whereas in non-polar studies the maximum zone of inhibition were found against *p.aeruginosa*.²⁰ *Invitro* antibacterial activity of leaf extracts of *A. malabarica* was tested against *E. coli*, *S. aureus*, *P. mirabilis*, *P.aeruginosa*, *K.pneumonia*. The report was showed that ethanolic extract exhibited a potent antibacterial activity at 200 μ g/ml and produced 25mm zone of inhibition against *S. Aureus* whereas Diethyl ether extract produced 30 mm zone of inhibition in the same concentration²¹ the methanol extract against gram positive and negative bacteria indicating good antimicrobial activity therefore justifying its usage in the traditional medication system for infectious diseases.²²

ANTI-INFLAMMATORY ACTIVITY

The members of *Anisomeles* have potent anti-inflammatory properties.²³ Significant anti-inflammatory activity of ethanol and aqueous extract of *A. malabarica* was reported in a dose dependent manner in comparison with the standard drug *indomethacin*.²⁴ The anti-inflammatory activity of the various extracts of *A. malabarica* was evaluated based on their effects on carrageen an-induced pawoedema and cotton pellet granuloma in rats, among the extracts tested ethanol and aqueous extracts of leaves of *A. malabarica* produced significant anti-inflammatory activities in a dose-dependent

manner.²⁵ Presence of *In-vitro* anti-Inflammatory, antiplatelet and anti-arthritis activities to the leaves of *A.malabarica* was reported.²⁶

ANTI CANCER ACTIVITY

The ethanolic extract of *A.malabarica* at an oral dose of 100 mg/kg body weight exhibited a significant protective effect by reduce in liver and serum levels of total protein glutamate pyruvate transaminase, glutamateoxaloacetate transaminase, acid phosphatase, and alkaline phosphatase.¹⁰ *n*-hexane and chloroform extracts of *A. malabarica* were cytotoxicity to the cervical cancer cells in dose- and duration-dependent manner. The cells that responded to the treatments revealed typical apoptotic features. Early features of apoptosis, phosphatidyl serine translocation and loss of mitochondrial trans-membrane potential, were noticed in the treated cells and comet assay revealed DNA damage. In the FACS analysis, the cells accumulated in the sub-G0/G1 phase of the cell cycle, except in *n*-hexane and chloroform extract treated SiHa cells at 24h, which showed arrest in S and G2/M phases.²⁷ Anisomelic acid (AA) was tested for its cytotoxicity and apoptosis-inducing potential in breast and cervical cancer cells. The MTT assay for cell viability indicated that AA is cytotoxicity to all types of cell lines tested in a dose and duration-dependent manner. Acridine Orange and Ethidium Bromide (AO & EB) and Hoechst33258 staining of AA-treated cells revealed typical apoptotic morphology such as condensed chromatin and formation of apoptotic bodies. The comet assay revealed DNA strand break(s), indicating that AA induces DNA damage which culminates in apoptosis.²⁸ The effect of *A. malabarica* whole plants methanol extract has been studied on cellular redox status during hamster buccal pouch carcinogenesis. In the buccal pouch, *A.malabarica* reversed the susceptibility to lipid per oxidation while simultaneously increasing GSH-dependent antioxidant enzyme activities, whereas in the liver and erythrocytes, the extent of lipid per oxidation was reduced with elevation of antioxidants. The report showed that protective role against HBP carcinogenesis may be related to the antioxidant and anti-proliferative properties of phytochemical such as flavonoids present in the plant.²⁹

ANTI PROLIFERATIVE

Anti-proliferative property of *n*-hexane and chloroform extracts of *A. malabarica* have been demonstrated against human cervical cancer the report was can inhibit proliferation of cervical cancer cells and induce death in HPV16- positive cervical cancer cells.²⁷

ANTIPLASMODIAL ACTIVITY

Among 10 experimental plant extracts tested, the leaf methanol extracts of *A. malabarica* and *Ricinus communis* showed good antileishmanial activity IC₅₀ is 126±19.70 and 184±39.33µg/mL), respectively against promastigotes of *Leishmaniadonovani*.³⁰

ANTI-PYRETIC ACTIVITY

Anti-pyretic activity of various extracts of *A.malabarica* was evaluated using the brewer's yeast induced pyrexia in rats. The extracts in dose levels of 50, 100 and 200

mg/kg orally were used for antipyretic studies. The three extracts have shown a good anti-pyretic effect with all the doses used.²⁵

LARVICIDAL ACTIVITY

The acetone, chloroform, ethyl acetate, hexane, and methanol dried leaf, flower, and seed extracts of *Anisomeles malabarica* and other plants were tested against the larvae of cattle tick *Rhipicephalus microplus*, sheep internal parasite *Paramphistomum cervi* at 2,000 ppm and fourth instar larvae of *Anopheles subpictus* and *Culex tritaeniorhynchus* at 1,000 ppm. All plant extracts showed moderate effects after 24 h of exposure; however, the highest parasite mortality was found in the leaf methanol extract of *A. malabarica*, leaf acetone and chloroform of *A. malabarica*, flower chloroform extract of *A. malabarica*, flower were effective against the larvae of *C. tritaeniorhynchus* (LC₅₀ = 68.27, 95.98, 59.51, and 93.94 ppm; LC₉₀ = 306.88, 393.83, 278.99, and 413.27 ppm), respectively³⁰. The larvicidal activity of two indigenous plants, *A. malabarica* and *Phyllanthus emblica* against the larvae of economically important malarial vector, *Anopheles stephensi* under laboratory condition was evaluated and found that the methanol extract of both the plants showed significant larvicidal activity and also combined extracts (synergistic) exhibit highest larval mortality.³¹

ANTI-ANAPHYLACTIC

Anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death. Anaphylaxis is a severe, potentially fatal, systemic allergic reaction that occurs suddenly after contact with an allergy-causing substance. Worldwide 0.05-2% of people is estimated to have anaphylaxis at some point in their life and the occurrence rate appears to be increasing.³⁰ Currently, focus on plant research has improved all over the world and a large body of evidence is accumulated to show immense potential of medicinal plants used in various traditional systems. *A. malabarica* has essential chemical compounds serve as an anti-anaphylactic agent³³.

ANTI EPILEPTIC ACTIVITY

The antiepileptic is adverse group of pharmaceuticals used in the treatment of epileptic seizures. Single dose pre-treatment with total flavonoids fraction of *A. malabarica* (25 and 50 mg/kg, i.p.) has found to be effective against both maximal electroshock and pentylenetetrazole -convulsions, but associated with a marked decrease in locomotor activity and motor activity performance (i.e., neurotoxic effects), similar to that of diazepam treatment. Interestingly, chronic treatment with total flavonoids fraction at lower doses (6.25 and 12.5 mg/kg, i.p., 1 week) has also produced significant antiepileptic activity, but without causing neurotoxic effects⁷.

CONCLUSION

Members of the genus *Anisomeles* are widely used in traditional system of medicine from several decades in many countries like India. Now the scientific research on the species *Anisomeles malabarica* suggests that these plants have pharmaceutical importance. Presence of chemicals which support various biological activities are presented in this paper providing evidence for use of these plants in developing new drugs for curing various ailments. There is a need to standardize methods for isolation of

active principles in pure forms to produce new standardized drugs. The active principles which are present in these plant showing strong antioxidant, anti-inflammatory and anticancer properties. In these days it is very essential to develop natural drugs against cancer. Developments of natural antioxidants from these plants help the food and pharmaceutical industries.

REFERENCES

1. Mulukuri NVLS, Mondal NB, Prasad MR, Renuka S, Ramakrishna K. Isolation of diterpenoid lactones from the leaves of *Andrographis paniculata* and its anticancer activity. *Int J Pharmacog Phytochem Res* 2011; 3 (3): 39-42.
2. Sivananthan M. Antibacterial activity of 50 medicinal plants used in folk medicine. *Int J Biosci* 2013; 3 (4): 104-121.
3. Sivananthan M, Elamaran M. In vitro evaluation of antibacterial activity of chloroform extract *Andrographis paniculata* leaves and roots, *Duriozibethinus* wood bark and *Psidium guajava* leaves against selected bacterial strains. *Int J Biomol Biomed* 2013; 3 (1): 12- 19.
4. Abu –Asab M.S and cantino P.D, phylogenetic implications of leaf anatomy in subtribemellitidine (Labiatae) and related taxa; *J. Arnold Arbor.* 1987; 68, 1-34.
5. Orient Longman, *Indian Medicinal Plants*, Orient Longman Ltd, Madras, Volume I, 1994;157-159.
6. Singh I et al. Anticonvulsant potential of *Anisomeles malabarica* leaves against experimentally induced convulsions in rats. *International Journal of Green Pharmacy* 2010; 4: 199-20.
7. Choudhary N, Bijjem KR and Kalia AN, Antiepileptic potential of flavonoids fraction from the leaves of *Anisomeles malabarica*. *J Ethnopharmacol.* 2011; 135(2):238-242.
8. Gupta AK, Tandon N and Sharma M , *Quality Standard of Indian Medicinal Plants*. Medicinal Plants Unit, Indian Council of Medicinal Research, New Delhi, 2008; Vol. 6: 28-37.
9. Chopra RN, Nayar SL and Chopra IC, *Glossary of Indian Medicinal Plants*, Council of Scientific and Industrial Research, New Delhi 19, 1956.
10. Jeyachandran R, Mahesh A and Cindrella L, *Int J Can Res*; 2007;3 (4): 174-179.
11. Raffuf RF, *A Guide to their discovery and Distribution*. Haawkworth Press, Inc. NewYork,1996; p.35.
12. Raja B, Manivannan J. Evaluation of in vitro antioxidant and antimicrobial potential of methanolic leaf extract of *Anisomeles malabarica* (Linn.). *J Pharm Res*, 2010;3: 1188-1191.
13. Sini KR, Sinha BN, Karpagavalli M. Determining the antioxidant activity of certain medicinal plants of Attapady, (Palakkad), India using DPPH Assay. *Curr Bot*, 2010;1: 13-17.
14. Vijayalakshmi R, Ranganathan R. Antimicrobial activity of various extracts of whole plant of *Anisomeles malabarica* (Linn.)R. Br. *Int Multidisciplinary Res J*, 2011;1: 15-19.
15. Vijayalakshmi R, Ranganathan R. Evaluation of in vitro antioxidant potential of ethyl acetate leaf extract of *Anisomeles malabarica* (Linn.)R.Br. *Int J Chem Anal Sci*, 2011;2: 93-96.
16. Subramanian S, Vedanarayanan S. In vitro antioxidant potential of ethanolic extract of *Anisomeles malabarica*. *IRJP*, 2012;3: 394-398.
17. Vinod G, Ramesh BS, Suvarna MNV, Hanumanthappa KM. In-vitro antioxidant potential of solvent extracts from *Anisomeles malabarica*. *J Pharmacog Phytochem*, 2014; 3: 99-103.

18. Packialakshmi N, Nisha HMN. Bioautographyscreening of *Anisomeles malabarica* leaves andboiled leaves. Pharma Innovation J, 2014; 3:77-80.
19. Vinod G, Hanumanthappa KM, Suvarna MNV,Rashmi TS. In vitro antimicrobial activity andpreliminary phytochemical investigation of*Anisomeles malabarica* from Western Ghats,Karnataka. Int J SciEng Res, 2014; 5: 681- 684.
20. Packialakshmi N, Nisha HMN. Bio-inspiredsynthesis of silver nanoparticles andantimicrobial activity in *Anisomeles malabarica* Plant. AJPCR, 2014; 2: 105-115.
21. Rajarajan PN, Rajasekaran KM, Devi NKA.Antimicrobial activity and phytochemicalanalysis of *Anisomeles malabarica* (L.) R.Br. on aflatoxin producing fungi. J Sci, 2014; 4: 371-376.
22. Singh I, Singh M, Singh T, Bijjem KRV, Kalia AN. Anticonvulsantpotential of *Anisomeles malabarica*leaves against experimentally induced convulsions inrats. International journal of green pharmacy 2010; 4: 199-205.
23. Dharmasiri M, Thabrew M, Ratnasooriya W.Anti-inflammatory effects of *Anisomelesindica*.Phyto Med, 2000;7: 97- 99.
24. Srinivasan P, Sudha A, Bharathajothi P, Rameshthangamp, Manikandan R, Arulvasu C. Effects of antiinflammatoryand anti-pyretic activity of *Anisomeles malabarica* R.Br. Journal of Pharmacy Research, 2010; 3: 1598-1601.
25. Pappu S, Arumugam S, Bharathajothi P,Palanivel R, Ramar M, Chinnasamy A. 2010.Effects of anti-inflammatory and anti-pyreticactivity of *Anisomeles malabarica* R.Br. JPharm Res, 2010;3: 598.
26. Lavanya R, Maheshwari SU, Harish G, Raj JB,Kamali S, Hemamalani D, Varma JB, ReddyCU. Investigation of In-vitro anti-Inflammatory,anti-platelet and anti-arthritic activities in theleaves of *Anisomeles malabarica* Linn. Res JPharmaceutBiolChemSci, 2011;1: 751-754.
27. Preethy CP, Padmapriya R, Periasamy VS,Riyasdeen A, Srinag S, Krishnamurthy H,Alshatwi AA, Akbarsha MA. Antiproliferativeproperty of n-hexane and chloroform extracts of*Anisomeles malabarica* (L). R. Br. in HPV16-positive human cervical cancer cells. PharmacolPharmacother, 2012;3: 26-34.
28. Preethy CP, Alshatwi AA, Gunasekaran M,Akbarsha MA. Analysis of the cytotoxic potential of anisomelic acid isolated from *Anisomeles malabarica*. Sci Pharm, 2013;81: 559-566.
29. Ranganathan R, Vijayalakshmi R. Effect of*Anisomeles malabarica* (L.) R.Br. Methanolicextract on DMBA - induced HBPCarcinogenesis. Int J Drug Dev Res, 2012;4: 175-183.
30. Zahir AA, Rahuman AA, Pakrashi S, GhoshD, Bagavan A, Kamaraj C, ElangoG, Chatterjee M. Evaluation of antileishmanialactivity of South Indian medicinal plants againstLeishmania donovani. ExperimentalParasitolog, 2012;132: 180-184.
31. Jayakumar J, Elumalai K, Dalmin G,Krishnamurthy R. Larvicidal and synergisticactivity of *Anisomeles malabarica* andPhyllanthusemblica against the larvae ofcommon malarial vector, Anopheles stephensiListon. (Diptera: Culicidae). 2014 ; Discovery, 20: 36-41.
32. Tintinalli, J.E, Emergency Medicine: AComprehensive Study Guide (EmergencyMedicine (Tintinalli)). New York: McGraw-Hill Companies 2010.
33. Kavitha, T., R. Nelson, R. Thenmozhi and E.Priya, Antimicrobial activity andphytochemical analysis of *Anisomeles malabarica* (L) R.Br. J. Microbiol.Biotech. 2012;Res.2 (1): 1-5.