MAJORANA HORTENSIS (M.): A REVIEW UPDATE


Department of Pharmacology, Bharathi College of Pharmacy, Bharathi Nagar, Mandya Dist, Karnataka – 571422

ABSTRACT

Majorana hortensis (M.) is valued in Indian traditional systems of medicine for improving antiseptic, antispasmodic, carminative, stimulant, and expectorant and nerve tonic rheumatic habits, stimulates moreover the blood circulation, nerve habits, muscle pain, muscle rheumatism, arthritis, flu, cold, bronchitis, stucked cough, asthma, hiccups, slow digestion, bad appetite, menstruation problems, low blood pressure, worm infections, cramps, mould infections, the present review is an up-to-date and comprehensive literature analysis of the chemistry, ethno pharmacology and therapeutically uses of Majorana hortensis (M.)

Keywords: Majorana hortensis (M.), Harvesting and post-harvest management, Ethnopharmacological actions and Applications.

INTRODUCTION

This review emphasizes on the traditionally used and clinically potential plant, i.e., Majorana hortensis (M.) and additionally, it raises a question on the pharmacological work on the plant, through this review, authors wish to attract attention of the herbal product researchers throughout the world to explore this potential plant systematically.

The review has been compiled using references from major databases such as chemical abstract, medicinal and aromatic plants Abstracts, pubmed, henriette’s herbal home page, Duke’s phytochemical and Ethnobotany database.

Majorana hortensis (M.) (Sweet marjoram) of the Labiatae family, is indigenous to mediterranean countries and was known to the ancient Egyptians, Greeks and Romans [1]. They cultivated it as a pot herb and used it not only to flavor food but also prized it as a miraculous herb with the power to heal practically all diseases, especially colds and chills. The Greeks felt it a symbol of happiness and that if grown on the grave, the deceased would be eternally happy. Marjoram was popular during the middle Ages as a medicine and as a culinary herb in England during the sixteenth century. Now marjoram
is grown in central Germany, Hungary, and southern France and in the USA. It is also grown in western Asia, South and North America, France, Spain, Portugal, the UK, North Africa, Morocco, Tunisia, China, Russia and India. For many years both marjoram and oregano were known as *Origanum Majorana*. Today marjoram is identified as *Majorana hortensis* as a member of the mint family, it is an aromatic herb of the mint family and grows to a height of 30 to 60 cm. The herb develops a large number of leafy stalks with small leaves. The leaves are whole and the large ones are always fragmented. Leaves are light, greyish green and oblate to broadly elliptical, margin entire, reaching about 21mm in length and 11mm breadth, the flowers are small, white or pinkish or red. Essential oil is very strong and of very pleasant fragrance. The highest percentage is found in the leaves, whereas only traces are found in flowers and stalks.

**HISTORY:**

The Greeks left us the legends and the name of this ancient kitchen herb: oros ganos, meaning joy-of-the-mountain. Those who visited Greece, where oregano (wild Marjoram) covers the hill slopes and gives the summer air her smell, will certainly affirm its names. The sweet-spicy smell of Marjoram is said to be created by Aphrodite as a symbol for luck. Bridal couples were crowned with garlands of Marjoram and plants were placed on tombstones to give rest to haunted spirits. Aristotle reported that turtles that eated a snake immediate had to eat oregano not to die, thus became oregano also taken by men as anti-poison. The Greeks loved the smell after a bath, as Marjoram oil was massaged on their forehead and in their hairs. Before already, in the old Egypt, it was known that oregano can cure, disinfect and preserve food and that knowledge since then has been kept. Real Marjoram was introduced in the middle Ages in Europe and was popular among the ladies "to put in bouquets, herb bump and smell water". The leaves were rubbed also over oak pieces of furniture and floors to get a fragrant glow over it. By thunderstorm, the milk girls put Marjoram in the buses of fresh milk to keep the sweetness of it. Wild Marjoram resembles Thyme and became by the peoples medicine also for the same qualities valued. More particular the use as a stomach strengthening and cough lowering properties and as expectorants.
Marjoram is known by the following names: [6]

- English: Marjoram
- French: Marjolaine
- German: Majoran
- Italian: Maggiorana
- Spanish: Mejorana

Scientific classification [6, 7]

- Kingdom: Plantae
- Order: Lamiales
- Family: Lamiaceae
- Genus: *Origanum*
- Species: *O. majorana*
- Binomial name: *Origanum Majorana*

Other species:

Wild marjoram

Wild marjoram (*Origanum vulgare*) is a perennial herb native to Europe and West Asia and is commonly found in dry places and as hedge banks in England and has been naturalized in the United States.
**Pot marjoram**

This is also a Mediterranean plant growing to about 30 cm in height. Pot marjoram is cultivated for its aromatic leaves and is used for flavouring food. Another species of origanum commonly known as certain dittany is cultivated particularly on the island of Crete (it is known as *dictamo*, *ditamo*, *eronatus*, *stomatochorto* and *malliaro-chorto*) and is used mainly for medicinal purposes though also as a food flavouring.\(^4\)

**Harvesting and post-harvest management**

**Harvesting**\(^8,\,9\)

Marjoram grown in India is harvested from January to March. The foliage is cut off about 6 cm above the ground and it will put out new shoots and yield another crop in autumn. According to Prakash (1990) the first harvest of the leaves and tender tops of the herb is done as flowering commences. The plants are cut 5 to 8 cm above ground level and, with favourable conditions, a second cutting may be made two months later. In North Europe marjoram is usually replanted annually. Aharoni *et al.* (1993) have pointed out that young fresh green marjoram becomes a highly perishable produce due to senescence-accelerated metabolism accompanied by loss of freshness, chlorophyll and culinary quality and hence post-harvest management is necessary. It was observed that though the best yields of herb, leaves and oil were obtained from the second and third harvest of each season, the oil content of leaves was lower in the second year. However, in years with favourable climatic conditions, a second and third cut may be made, although plants in these cuts reach only a preflowering stage. The greatest decrease in the rates occurred during the first 18 h after cutting. The essential oil balance measured over the post-harvest period increased slightly (10%). Essential oils and their composition are the most important characteristics that determine the economic value of marjoram as an aromatic plant. At 30°C of first harvesting at the optimal stage (10 to 30% flowering) gave a higher essential oil (22%) than freshly harvested dried material, but physiologically younger plants (second cut) even showed a 35% increase. In some cases the proportion of *cis*sabinenic hydrate and sabinenic hydrate-acetate increased slightly at 20°C and 30°C while there was only a minor influence on and terpinenes and 4-terpineol. They have opined that respiration energy is involved actively in synthesis of essential oil.
in plant tissue and that the high respiration rate has to be considered in the development of future equipment and technologies for ventilating, cooling and drying during the post-harvest period.

**Post-harvest drying and storage.**[10]

After the harvest the leaves are dried, carefully cleaned and stored. Methods of drying depend on the size of the crop and climatic conditions in the producing countries. Cut plants may be tied as bunches in small quantities and dried in the open air or spread on wire trays in ventilated rooms and dried by regulated circulation of warm air. Sun drying may take two to four days for drying and in the case of ventilating drying sheds it may take more than a week. Stems or stalks are separated from leaves by rubbing on hand. Chaff is removed by using a fan and extraneous sand, earth and dust are removed by shaking in wide-meshed sacks (Guenther, 1974). More recently in Egypt the harvested material is pre-dried in the field and then in a solar drier to reduce the microbial load to less than 50% in comparison with the traditionally dried material. Buckenhuskés *et al.* (1996) used a solar greenhouse drying system for marjoram in Egypt and found that the shoot essential oil content after drying was 98% of the initial value. Microbial load could also be reduced considerably by this improved method. Singh *et al.* (1996) found that microwave blanching of marjoram gave the maximum retention of ascorbic acid (21.5% which is 79.4% of the composition of fresh herb). Blanching resulted in better retention of the original green colour of the fresh herb compared to direct drying of the herb. The herb had firmer texture when microwave blanched than when blanched by other methods and when fresh. Paakkonen *et al.* (1990), while studying the effect of drying, packing and storage on quality of herbs, found that odour and taste of freeze-dried marjorams were sensitive to storage conditions. Freeze-dried marjoram exhibited a much more intensive colour than air-dried marjoram. After nine months of storage in the light or raised temperature, the colour tone of the freeze-dried marjoram had changed only slightly. The intensity of the odour and taste of the airdried marjoram stored under vacuum was higher relative to the marjoram in glass jars or paper bags. An elevated storage temperature of 35°C was found to have a more detrimental effect on sensory quality than packaging. It was concluded that the intensity of odour and taste of dried herbs could be maintained for two years at 23°C in airtight packaging. Malmsten *et al.* (1991) demonstrated that freeze-
drying was more effective than airdrying as a means of preserving the herb and also for microbial decontamination. Raghavan et al. (1997) noticed that convection drying at about 45°C for 6 h preserved the flavour quality of marjoram to a greater extent than microwave drying.

**Composition:**

Many investigators have made studies on the composition of essential oil of marjoram and the important findings have been compiled by Lawrence (1981, 1983, 1984, 1989, and 1997) and Prakash (1990). Verghese (2000) has reported the following types of compounds in sweet marjoram. Monoterpenoids:
a-pinene 1.5%, beta-pinene 0.2-2.5%, sabinene 2.5-10%, myrcene 1-9%, a-terpinene 6-8%, y-terpinene 14-20%, paracymene 5.5%, terpinolene 1-7%, a-phellandrene, beta-phellandrene 4%
Sesquiterpenoids:
beta-caryophyllene 2.5-3%, a-humulene 0,1%
Monoterpenols:
linalool 2-5%, terpine-1-ol-4 14-22%, terpine-1-ol-3 0.3%, a-terpineol 3-6%, cis-thuyanol-4 4-13%, trans-thuyanol-4 1-5%
Terpenic esters:
linalyl-acetate 0.1-3%, terpenyl-acetate, geranyl-acetate 1,2%
Phenol-methyl-ethers:
trans-anethol -0,5%

**Monoterpene biosynthesis:** [12, 13, 14]
1. Monoterpenes: terpinolene, phellandrene,terpinene, terpinene limonene, sabinene, thujene, pinene, pinene, camphene, myrcene, ocimene
3. Monoterpene carbonyls: carvone, thujone, camphor
4. Monoterpene esters: neral acetate, geranyl acetate, linalyl acetate, and terpenyl-4-acetate

5. Sesquiterpenes: caryophyllene, humulene, copaene, farneolene, ledene, elemene, 
   bisabolene, bicyclogermacrene, allo-aromadendrane

6. Terpinoid ether/oxides: 1, 8-cineol, arylphyllene epoxide

7. Benzoid compounds: p-cymene, eugenol, thymol, carvacrol, methyl chavicol, anethole, 
   polyphenols, flavone designated majoranin, monoterpenic alcohols in the alcoholic 
   distillate was only.

Ethno pharmacological actions:

1. Essential oil. \[15, 16, 17\]

    Sweet marjoram essential oil, known in the trade as ‘Oil of sweet Marjoram’, is 
    obtained by steam distillation of the dried leaves and the flowering tops of the herb 
    yielding 0.3 to 0.4% oil from fresh and 0.7 to 3.5% from dry herb. Considerable 
    variations in the compositional pattern are observed depending on the origin of herb, 
    climatic and drying conditions, production procedure of the oil and many other factors. 
    The aroma and taste are spicy, fragrant, warm, aromatic, penetrating and resemble that of 
    lavender. The taste has a slightly bitter after taste.

2. Free radical scavenging and anti acetyl cholinesterase activities of \textit{Majorana hortensis}(M.) essential oil:\[18\]

    \textit{Majorana hortensis} (M.) essential oil was analyzed by gas chromatography-mass 
    spectrometry (GC-MS) and evaluated for free radical scavenging and anticholinesterase 
    activities. GC-MS analysis revealed the presence of 4-terpineol (29.97%), \(\gamma\)-terpinene 
    (15.40%), trans-sabinene hydrate (10.93), \(\alpha\)-terpinene (6.86%), 3-cyclohexene-1-1 
    methanal, a, a4-trimethyl-(S)-(CAS) (6.54%), and sabinene (3.91%) as main 
    constituents. \textit{Majorana hortensis}(M.) exhibited concentration-dependent inhibitory 
    effects on 2,2’-diphenylpicrylhydrazyl (DPPH'), hydroxyl radical, hydrogen peroxide, 
    reducing power, and lipid peroxidation with IC\(_{50}\) values of 58.67, 67.11, 91.25, 78.67, 
    and 68.75 \(\mu\)g/ml, respectively; while the IC\(_{50}\) values for the standard trolox were noted to 
    be 23.95, 44.97, 51.30, 42.22, and 52.72 \(\mu\)g/ml, respectively. Interestingly, cholinesterase 
    inhibitory activity was also found with IC\(_{50}\) values of 36.40\(\mu\)g/ml. We can conclude that 
    the marjoram has a significant potential to be used as a natural antioxidant and anti-
    AChE.
3. Insecticidal and synergistic effects of *Majorana hortensis* essential oil and some of its major constituents: [19]

The essential oil from leaves of *Majorana hortensis* was isolated by hydrodistillation with a yield of 1.6% (wt/wt). The insecticidal activity of the oil was evaluated against fourth instars of *Spodoptera litoralis* Boisduval (Lepidoptera: Noctuidae) and adults of *Aphis fabae* L. (Hemiptera: Aphididae). The oil showed a remarkable toxic effect against *S. litoralis* in a topical application assay (LD50 = 2.48 µg per larva) and in a residual film assay (LC50 = 3.14 g/l). The oil of *Majorana hortensis* (M.) also exhibited a pronounced toxic effect against *A. fabae* adults with LC50 values of 1.86 and 2.27 g/l in rapid dipping and residual film assays, respectively. Gas chromatography-mass spectrometry analyses of *M. hortensis* essential oils revealed the presence of 31 compounds and the main components were terpinen-4-ol (30.0%), γ-terpinene (11.3%), and trans-sabinene hydrate (10.8%). Repeated column chromatography of *M. hortensis* oil on silica gel led to the isolation of two major constituents, which were characterized based on 1H-nuclear magnetic resonance and mass spectrometric data, as terpinen-4-ol and γ-terpinene. These two components were examined for their insecticidal and synergistic activities towards *S. littoralis* and *A. fabae*. Terpinen-4-ol and γ-terpinene exhibited a significant insecticidal activity against both insects, but γ-terpinene was more toxic than terpinen-4-ol. When tested in a binary mixture with the synthetic insecticides profenofos and methomyl, it was found that both compounds enhanced the insecticidal activity of these insecticides by two- to threefold. These results show that terpinen-4-ol and γ-terpinene have a synergistic effect on the insecticidal activities of synthetic insecticides profenofos and methomyl.

4. The apoptotic and anti-proliferative activity of *Majorana hortensis* (M.) extracts on human leukemic cell line: [20]

The anti-proliferative activity of plant extracts from *Majorana hortensis* (M.) was tested on human lymphoblastic leukemia cell line Jurkat. Cytotoxicity was examined using non-radioactive cytotoxicity assay and the IC(50) was calculated. At non-cytotoxic concentrations, the viability of cells decreased with increase of concentration of plant extract. The anti-proliferative effect was also found to be dose-dependent. Analysis via flow cytometry shows that marjoram extracts stimulated apoptosis. Induction of
apoptosis was caused by an up-regulation of p53 protein levels and down-regulation of Bcl-2alpha. Marjoram exhibited a strong scavenging activity (SC (50) =0.03mg dry weight). The conclusions from this study suggest that marjoram extracts exhibit anti-proliferative effect and high antioxidant activity

6. **Protective Effect of *Majorana hortensis* (M.) on various models of gastric mucosal injury in rats.**[21]

The study was evaluated the antiulcerogenic activity of the ethanol extract in hypothermic restraint stress, indomethacin, necrotizing agents- (80% ethanol, 25% NaCl and 0.2 M NaOH) induced ulcers and basal gastric acid secretion using pylorus ligated Shay rat-model. Marjoram at doses of 250 and 500 mg/kg of body weight, significantly decreased the incidence of ulcers, basal gastric secretion and acid output. Furthermore, the extract replenished the ethanol-induced depleted gastric wall mucus and nonprotein sulfhydryls (NP-SH) contents and significantly lowered the increase in the concentration of malondialdehyde (MDA). Ulcer preventing potential was further confirmed by histopathological assessment. An acute toxicity test showed a large margin of safety of the extract in mice. The phytochemical screening of aerial parts of marjoram revealed the presence of volatile oil, flavonoids, tannins, sterols and/or triterpenes

7. **Antimutagenic and Genotoxic Potential of *Majorana hortensis* (M.)**[22]

The antimutagenic and genotoxic potential of *Majorana hortensis* (M.) was evaluated in *Vicia faba* root meristem cells. The root tip cells were treated with sodium aside at 250 and 350 µg/ml for 6 h and *Origanum majorana* was given at 50, 100 and 200 µg/ml for 20 h, prior to sodium azide treatment. The tips were squashed after colchicine treatment and the cells were analyzed for chromosome aberration and mitotic index. *Majorana hortensis* (M.) induces chromosomal aberration in *Vicia faba* root tip cells in an insignificant manner, when compared with untreated control. Sodium azide alone induces chromosomal aberrations significantly with increasing concentrations. The total number of aberrations was significantly reduced in root tip cells pretreated with *Majorana hortensis* (M.)

8. **Ursolic Acid of *Majorana hortensis* (M.) Reduces Aâ-induced Oxidative Injury**[23, 24]
Amyloid α protein (Ab) increases free radical production and lipid peroxidation in PC12 nerve cells, leading to apoptosis and cell death. The effect of ursolic acid from *Origanum majorana* L. on Aβ-induced neurotoxicity was investigated using PC12 cells. Pretreatment with isolated ursolic acid and vitamin E prevented the PC12 cell from reactive oxygen species (ROS) toxicity that is mediated by A α. The ursolic acid resulted in decreased A α toxicity assessed by 3-(4, 5- dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide (MTT), lactate dehydrogenase (LDH), and trypan blue assay.

9. Toxicity[25]

The toxicity of essential oil constituents from *Majorana hortensis*(M.), to eggs and adult females of the susceptible KR-HL and dual malathion- and permethrin-resistant BR-HL strains of human head louse, Pediculus humanus capitis, was examined using contact + fumigant mortality bioassay. Results were compared with those following treatment with two pyrethroid pediculicides, d-phenothrin or pyrethrum. As judged by the lethal time to 50% mortality (LT50) values at the exposure rate of 0.25 mg/cm2, 1,8-cineole (14.1 min) was the most toxic compound, followed by linalool (15.4 min) to KR-HL females. These compounds were faster acting than either d-phenothrin (24.1 min) or pyrethrum (33.4 min). Based on the lethal concentration causing 50% mortality (LC50) values, (−)-camphor (0.022 mg/cm2) was the most toxic compound, followed by linalool (0.035 mg/cm2), (−)-terpinen-4-ol (0.040 mg/cm2), α-terpineol (0.045 mg/cm2), and 1,8-cineole (0.068 mg/cm2) against KR-HL females. These monoterpenoids were less toxic than either d-phenothrin (LC50, 0.0015 mg/cm2) or pyrethrum (0.0013 mg/cm2). However, the toxicities of these monoterpenoids were almost identical against females from either of the two strains, even though the BR-HL females exhibited high levels of resistance to d-phenothrin [resistance ratio (RR), 667] and pyrethrum (RR, 754). After a 24 h exposure to linalool, BR-HL egg hatch was inhibited 100 and 84% at 0.25 or 0.125 mg/cm2, respectively, while (−)-terpinen-4-ol caused 94 and 69% inhibition of egg hatch at 0.25 and 0.125 mg/cm2. α-Terpineol caused 88 and 76% inhibition of egg hatch at 0.5 and 0.25 mg/cm2, respectively. Thus, certain monoterpenoids from *O. majorana* essential oil, particularly linalool, (−)-terpinen-4-ol and α-terpineol, merit further study as potential
pediculicides and ovicides for the control of insecticide-resistant P. h. capitis populations as fumigants with contact action.

**Applications of *Majorana hortensis***:

1. **As ethereal oil.**

   The ethereal oil is obtained by steam distillation of the flowering herb. It is light yellow by colour, with a warm, spicy chamfer like smell. The oil becomes brown when it gets older and contains a high content, 80-90%, phenols (cavaciol and thymol). Because of this is the one of the most antiseptic oils and kills many bacteria, moulds and viruses. Is used for that all sorts of infections. It is moreover an immune stimulant and a good expectorant (anti-slime). Through the good soothing working beneficially by nerve habits and rheumatic habits, stimulates moreover the blood circulation, nerve habits, muscle pain, muscle rheumatism, arthritis, flu, cold, bronchitis, belt rose, stucked cough, asthma, hiccups, slow digestion, bad appetite, menstruation problems, low blood pressure, worm infections, cramps, mould infections, bacterial- and virus infections 8 to 10 drops Oregano in the aroma lamp works stimulating by physical and mental tiredness and by a too low blood pressure.

2. **Antimicrobial properties:**[26]

   The antimicrobial effect of marjoram and found that fungi which were inhibited are *A. fumigatus* and *A. niger* antifungal activity of marjoram oil against the common spoilage fungus *Aspergillus niger* (strain IMI 17454) even at concentration of 1 micro litre/ml broth. Marjoram oil was most active in inhibiting the growth of *Acinobacter calcoacetica*, *Beueckea natriegens* and *Staphylococcus aureus*.

3. **Antioxidant properties:**[27,28,29]

   The discovery of inhibition of lipid oxidation by some phenolic compounds during the late 1940s has contributed to the application of synthetic antioxidants in the food industry Widely used artificial antioxidants such as butylated hydroxytoluene (BHT), and butylated hydroxyanisole (BHA) (Chan, 1987) are very effective in their role.

4. **Control of platelet aggregation:**[30]

   The inhibitory effect of methanol extracts of 20 herbal species on human platelet aggregation, a factor in conditions such as thrombosis. Allspice, basil, marjoram, tarragon and thyme strongly inhibited the platelet aggregation induced by collagen. Basil,
marjoram and tarragon strongly inhibited platelet aggregation induced by ADP. They isolated an active compound, arbutin, from sweet marjoram as an inhibitor of platelet aggregation.

5. Other therapeutic properties:

Yamazaki (1995) studied the effect of both medicinal and edible herbs and plants of the Labiatae family including marjoram against HIV. Though he found non-inhibitory action on HIV for 70% ethanol extract of marjoram, at a concentration of 31 _g/ml of water extract showed effects of inhibition of HIV-1 on Molt 4 (MT-4) cells. Formation of giant cell was also found to be inhibited by concentration of marjoram extract at 125 _g/ml.

Anderson et al. (2000) evaluated the effect of massage with essential oil on children with atopic eczema and found that aromatherapy massage is a good treatment for the control of atopic eczema.

Pruthi (1976) reported that intravenous injection of dogs with a saturated solution of essential oil in 33% ethyl alcohol (1 cc/kg body weight) increased peristaltic movement of intestine.

Studies by Krukowski et al. (1998) in Poland have shown that mineral herbal supplements including nettle, St. John’s wort, camomile, salvia, agrimony and marjoram tended to increase the immunoglobulin G (IgG) serum level of reared calves.

6. Uses in traditional medicine:

Use of marjoram in medicinal preparations was in vogue from many years back. Chopra et al. (1956) reported the use of marjoram oil in hot fomentations, for acute diarrhoea, and as an expectorant. Parry (1969) described marjoram to have properties of antiseptic, antispasmodic, carminative, stimulant, and expectorant and nerve tonic. It functions as cure for asthma, coughs, and indigestion, rheumatism, toothache and heart conditions. According to Mabey (1988) marjoram contains tonic and astringent bitter principles, which rouse the appetite and hence it is helpful for invalids the leaves and seeds of marjoram are considered as astringent and a remedy for colic (Dayal and Purohit, 1971). Chiej (1984) reported that the powder acts as a sternulatory (inducing sneezing) if inhaled, and is, therefore effective against head colds. Prakash (1990)
mentioned the use of volatile oil as an aromatic stimulant in colic, dyspepsia, flatulence and dysmenorrhoea.

7. **Use in food:** [32, 33]

Marjoram is used in many, marjoram is added to soups, salad dressings, sauces for stewed meats (mainly mutton) and stuffing’s.

8. **Functional properties:** [34]

Essential oils from aromatic and medicinal plants have been known since antiquity to possess biological activity, notably antibacterial, antifungal as well as antioxidant properties.

**Precautions:** [35]

Do never uses the ethereal oil undiluted, Oregano can sometimes skin and mucous membrane irritations cause. The most ethereal oils cannot be taken in without risk. Use ethereal exclusive internal oil when you have sufficient knowledge or consult a (homeopathic) physician. In general however the working by external use is stronger than by internal use. The ethereal oil can cause skin irritation.

**CONCLUSION**

*Majorana hortensis* (M.) has been in use since times immemorial to treat wide range of indications. It has been subjected to quite extensive phytochemical, experimental and clinical investigations. Its active constituents include Monoterpene derivatives, terpenic esters monoterpenol and sesquiterpenoids. Experimental studies have demonstrated its free radical scavenging, anti acetyl cholinesterase, insecticidal, synergistic effects, apoptotic, anti-proliferative activity, antimutagenic, genotoxic potential, antimicrobial and anti ulcer activity and it has been calming effect on anxiety and depressant activities. The scientific studies have proved the claims of Indian traditional systems of medicine. However, further detailed clinical research appears worthwhile to explore the full therapeutic potential of this plant in order to establish it as a standard drug.

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23. Chung YK, Heo HJ, Kim HK, Huh TL, Lim Y, Kim SK, Shin DH: graduate school of Biotechnology, Korea University, Seol.


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**For Correspondence:**
Boddu V N Satya Kumar
Tel no: +917676036039
Email: satyakumar91@gmail.com