

Medicinal Value of Domiciliary Ornamental Plants of the Asteraceae Family

Ishan Saini¹, Jyoti Chauhan¹, Prashant Kaushik^{2,3,*}

¹Department of Botany, Kurukshetra University Kurukshetra, Kurukshetra, Haryana, INDIA.

²Instituto de Conservación y Mejora de la Agrodiversidad Valenciana, Universitat Politècnica de València, Valencia, SPAIN.

³Nagano University, 1088 Komaki, Ueda, Nagano, JAPAN.

ABSTRACT

Gardens are unaccomplished without the showy, pricey investments of ornamental plants. Ornamental plants, especially the flowering plants, have a significant impact on human life. They offer fresh air to the surroundings and release the negativity from the environment. Ornamental plants intrigued humans with their alluring odour and unique. Besides this, many ornamental plants have other economic uses other than just decoration or traditional customs which has been discussed. Many plants are edible and used in several kinds of beverages as medicinal values. Important domiciliary plants that belong to Asteraceae with both ornamental and therapeutic benefits are reviewed in this paper, namely, *Calendula*, *Echinacea*, *Achillea*, *Acmella* and *Tanacetum*. These plants possess a high nutritive value and can be cooked or consumed as salads. With numerous pharmaceutical ac-

tivities of these plants, we hope that this review will bring awareness for their alternative use.

Key words: Edible flowers, Medicinal ornamental plants, Floriculture, Horticulture, Alkaloids, Essential oil.

Correspondence

Dr. Kaushik Prashant^{2,3}

²Instituto de Conservación y Mejora de la Agrodiversidad Valenciana, Universitat Politècnica de València-46022, Valencia, SPAIN.

³Nagano University, 1088 Komaki, Ueda, Nagano 386-0031, JAPAN.

Email: prakau@doctor.upv.es

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INTRODUCTION

Ornamental plants can provide multiple profits with regards to environment beauty, economy concern and human lifestyles.¹ Because of beautiful flowering and lovely attractive foliage, ornamental plants are being grown in homes, workplaces, institutions, etc., to embrace the landscape.² And also floriculture crop products are being exported to countries like the USA, Japan, the UK, Netherlands and Germany. Floriculture has opened an extensive opportunities for jobs, especially to plant breeders. Many flowers like lotus, hibiscus, rose, ponia, sunflower, etc., are used by devotees for spiritual enlightenment to different gods and goddesses.³ Growing ornamental trees can help in reducing the temperature. *Nyctanthes arbor-tristis*, known as night flowering jasmine is a good tree to be in lawns, which have white flowers with orange stalk, being used as 'gajaras', 'poojas' and in Ayurvedic medicines.⁴ Ornamental plants attract pollinators which can feed them through nectar present in their flowers that has high nutritive value for humans too.⁵

Floriculture as a specialized profession, has started in last two decades and is giving tough competition to world trade against other developing countries. Many ornamental plants are being used as indoor for spreading freshness inside homes, hospitals, etc. It has been noted that patient having plants inside their wards recover faster. Plants and flowers have long-term encouraging and constructive effects on human minds. Indoor air pollutants are micro particles that are hard to eliminate physically, but indoor plants can do this tedious job efficiently.⁶ *Hedera helix*, *Nephrolepis exaltata*, *Anthurium andreanum*, *Aglaonema modestum*, *Areca lutescens*, *Ficus salii*, *Chrysanthemum leucanthemum*, *Syngonium podophyllum*, *Chamaedorea elegans*, *Dracena marginata*, *D. sanderiana*, *Epipremnum aureum*, *Clophophytium comosum*, *Sansevieria trifasciata*, *Philodendron*, *Spathiphyllum*, etc., are some ornamental indoor plants those have specific volatile substances that can eliminate formaldehyde,

ammonia, benzene, xylene, carbon monoxide, chloroform and other toxic compounds in air.⁷

Despite the increasing interest of ornamental plants, some of them are also cultivated for their medicinal use as they have many bioactive compounds like phenolic compounds, carotenoids, antioxidants, essential oils and other secondary metabolites.^{8,9} Ornamental plants like *Ocimum* sp., *Nicotiana* sp., *Ixora*, *Aloe vera*, *Agave*, etc. and ornamental flowers like roses, nasturtium, hibiscus, marigold, *Calendula*, etc. are commonly grown in homes which also have many medicinal applications. Along with this, remedies from plants can be much cheaper and protect against free radicals without any side-effects than medicines formed by pharmaceutical companies. Like Carnations, which has a reputed status as a cut-flower worldwide but the petals of this flower can be used to cure skin problems and to reduce fatigue and stress. Many flowers are edible and can be used for flavouring curry, making sweet-dishes, *chutneys*, or hot beverages. For example, Japanese Honeysuckle, Woodbine Honeysuckle and Dandelion, have antioxidant properties and can be used for tea or in flavouring syrups with anti-inflammatory assets.¹⁰ Drinks made from flowers are devoid of caffeine, while other types of teas contain stimulatory drugs such as caffeine, theobromine and xanthenes alkaloid. In Europe, due to the high nutritive values of some edible flowers, hot beverages are served for providing wellness as they having medicinal properties. Lotus and Dahlias are used in making puddings, cupcakes, pastries and other bakery products. Lotus used for lowering blood sugar level, regulate the menstrual cycle and work as an anti-inflammatory agent while Dahlias have antibacterial and antiviral activities.¹¹ Ornamental flower-like *Tagetes erecta* (Family: Asteraceae), mainly used as garden flowers, in garlands, decorating homes, banquets and can be used as an analgesic as well as an antioxidant.¹² Members of Asteraceae family

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having beautiful yellowish-white flowers used in beverages having anti-oxidant properties as well as in curing stomach ache.¹³

Herbalists can tell the medical benefits of the particular plant. Some people, may not have a proper degree can understand the benefits of plants growing naturally around them. So this paper is comprised of some of the ornamental plants which are beneficial for medical purpose and other economic uses considering floriculture as a different opportunity to sell more products. Here, we have discussed five medicinal plants of family Asteraceae, namely, *Calendula*, *Echinacea*, *Achillea*, *Acmella* and *Tanacetum*.

Following are some ornamental plants discussed which are essential as floral crops plus have medical practicalities.

ORNAMENTAL PLANTS

CALENDULA OFFICINALIS L. (POT MARIGOLD)

Family: Asteraceae (Sunflower family)

Main use: Garden flowers

Flowering period: August to November

Scientific Classification

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Asterales
Family	Asteraceae
Genus	<i>Calendula</i>
Species	<i>officinalis</i>

Calendula which is native to Southern Europe, is herbaceous annual plant mainly grown in late summers to early winters that are highly branched with hairy stem and reaches up to a height of 80cm. The plant can grow in any soil and needs partial to full sun for flowering. Butterflies and bees are attracted to their dazzling orange flowers. Leaves (6-15cm long) of the plant are alternate, lanceolate, hairy from both sides with wavy margins. The inflorescence is capitulum of 5-8cm in diameter, with single row of ray florets at periphery around the central tubular disc florets. Florets are aromatic and give pungent spicy flavour to the food items while the leaves have a bitter taste. Fruits are thorny achene.

Calendula is an ancient plant used as both ornamental in cottage botanical gardens and cemeteries since the 12th century as well as medicinal uses. *Calendula officinalis* Linn. has a long history of usage by the folklore system, because of rich ethnomedicinal values. *Calendula* flowers are often used in skincare.¹⁴ Leaves and flowers are an excellent source of skin diuretics and for skin burns. The flowers have also been used as a source of medicinal ingredients, widely used in homoeopathic medicine for the treatment of many diseases for centuries.¹⁵ *C. officinalis* has high economic value as herbal medicine and has been approved recently for food use in USA and appears in the Food and Drug Administration (FDA) list of generally recognized as safe (GRAS) substances.¹⁶ Studies had shown various pharmacological activities viz. nephroprotective, hepatoprotective, hypoglycemic, hypolipidemic, antioxidant potential of *C. officinalis* in experimental and clinical models. Therefore, the correlation between phytochemical ingredients associated with pharmacological activities needs to establish to maximize their therapeutic applications in mammals. Plants were used by the soldiers during the American Civil War for quick recovery of wounds. *Calendula* has anti-inflammatory, anti-oede-

matous, anti-Tumor-Promoting and anti-oxidative properties.¹⁷ Europeans use leaves as diaphoretic and resolvent while the floral parts are used as antispasmodic, stimulant and emmenagogue.¹⁸ The decoction of the flowers was earlier used for treating measles and smallpox and suppression of menstrual flow.¹⁹ In India, *Calendula* is often used for curing cut, burns, rashes, dry skin, varicosis and dermatitis.²⁰ (20 Maryland, 2011). Sesquiterpenes and saponins extracted from the plant can be used as against viral infection and mutagenic compounds like benzo (a) pyrene.²¹ T-muurolol, α -humulene, α -thujene, α -terpeneol, α -gurjunene, aromadendrene, 1,8-cineole, δ -cadinene, γ -cadinene, β -pinene, β -caryophyllene, Myrcene, Sabinene, Nonanal, Bornyl acetate etc. are other compounds which are extracted from the plant and therapeutically important.^{22,23} Growing *Calendulas* is very good for the ground-field cover, flowerbed edges and in containers. Some people also make tea by using flowers. The plant is very beneficial for skin repair. Dye also extracted from the flower for colouring fabrics. So it is a critical economic plant to grow. The pharmacological activity of *C. officinalis* is presented in Table 1.

Antioxidant activity

Plants are the natural reservoir of antioxidants that inhibit the oxidative stress created as a consequence of the production of free radicals or ROS (reactive oxygen species). Plants produce low molecular weight antioxidant (such as Vitamin C, Vitamin E, phenolic acids, etc.) and high molecular weight secondary metabolites (phytochemicals) against the oxidative stress. These antioxidants are served as a potent free radical scavenger and play a significant role in the treatment of various diseases of humans. *Calendula officinalis* plant parts also possesses significant antioxidant properties. Aglycon (flavonoids), saponosides, sterol and carotenoids (lipids), isorhamnetin and quercetin (glycosides of flavonol) and organic acids in abundant amount are present in the flowers of this plant.³⁴ The *Calendula* plant extract significantly increased the activity of catalase, glutathione reductase and decreased the glutathione peroxidase activity after oral administration has given to mice for one month.³⁵ The butanolic fraction of plant extracts exhibit influential free radical damaging, antioxidant potentiality and provide protection to rat liver microsomes against lipid peroxidation.³⁶ The phytochemical constituents of *Calendula officinalis* extract exhibited high *in vitro* antioxidant potentiality and DPPH (1, 1-diphenyl 1-2- picrylhydrazyl) induced the ROS scavenging activity along with high reducing capability.³⁷ Propylene glycol extracts of the flower head and petals showed that the extract of the petals was found to be more effectual in contrast to the extract of flower head.³⁸ Hence the dietary supplements of *C. officinalis* plant extract act as a source of natural antioxidant and may be used for providing the protection against ageing, cancer, etc. which resulted from the cellular damage created by free radicals.

Anti-inflammatory and analgesic effect of *C. officinalis*

C. officinalis floral extract exhibited anti-inflammatory effectivity in case of both carrageenins such as histamine, kinins, prostaglandins and dextran such as mast cell degranulation. The interferon- γ (IFN- γ), histamine, prostaglandins, etc. released into the circulatory system that mediates the inflammatory response of host cell. *C. officinalis* plant extract decreased the level of (IFN- γ) and also retarded the cyclooxygenase 2 (COX-2) expression which also involved in anti-inflammatory responses.³⁹ The plant extract of *Calendula* significantly reduced the synthesis of reactive oxygen species (ROS) and reactive nitrogen species (RNS). During the chronic inflammation, it also retarded the suppression of neutrophils, eosinophils and macrophages that causes the cell damage.^{39,40} A large amount of flavonoids, carotenoids and lycopene (which served as a potent antioxidant) present in the flowers of *C. officinalis* the lower concentration of lutein flavonoids showed strong inhibitory potential against endogenous reactive oxygen species.⁴¹ Carotenoids significantly

inhibit the reactive oxygen species and lycopene greatly reduced the transcription of cytokines.⁴² Caffeic acid, chlorogenic acid and alkylamines contribute the biological activity of *E. purpurea*.⁴³

ECHINACEA PURPUREA (L.) MOENCH. (ECHINACEA)

Family: Asteraceae (Sunflower family)

Main use: Garden flower, cut-flower

Flowering period: April to October

Scientific Classification

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Asterales
Family	Asteraceae
Genus	<i>Echinacea</i>
Species	<i>purpurea</i>

Echinacea is a herbaceous perennial herb that can grow up to 1.2m and is native of North America which was brought to Europe in the late 19's. Flower of the plant can attract birds especially the hummingbirds and butterflies and bees too. Leaves (16 × 11 cm) are lanceolate arising from the base of the stem. *Echinacea* also is known as 'purple coneflower' that prefers soil with neutral pH and full sun that need less irrigation. Soil type can be rocky, clayey or sandy. With a capitulum inflorescence of 6-13cm, florets are hermaphroditic purplish-violet with dome-shaped disc floret.⁴⁴

Purple coneflower contains many constituents like polysaccharides, phenolics, caftaric acids, p-coumaric, kaempferol, glycoproteins, p-hydroxybenzoic, protocatechuic acids and the important one, cichoric acids. Along with cichoric acids plant also have rosmarinic acid, 2, 2-diphenyl-1-picrylhydrazyl, flavonoids and otheralkamides. Other alkamides like- isobutylamide, 2-methylbutylamide, nitidanin-diisovalerianate, germacatriene, etc. The plant is used as immunostimulation and immunomodulation, as well as work against the common cold and respiratory infection. *Echinacea purpurea* plant extract has antibiotic, antiviral, anti-fungal anti-cancerous potential⁴⁵⁻⁴⁸ and effectively used against snakebite, toothaches, cold and rabies-like diseases.⁴⁹ *E. purpurea* roots found to be a potent reservoir of Glycoproteins, alkylamides and polysaccharides that are served as source of immunomodulatory activities.⁵⁰

The root extract of coneflower can be used to up-regulate some genes like- interleukin-7 receptor, Chemokine (C-C motif) ligand-4, T-box transcription factor, integrin, cytohesin-interacting protein, intercellular adhesion molecule-1, etc., which are involved in cell immune system. Interestingly, the plant has a mosquitocidal property.^{51,52}

Echinacea is a plant used for ornamental purpose perfect for small gardens as flowerbeds, or alongside curbs/walkways. It is a beneficial plant in gardens having unique floral shapes. *Echinacea* is also being noted to fight against diseases of ornamental fishes as noted in *Poecilia reticulata*. So it is advised to have coneflower supplement in fish diet to increase the aquaculture production. The plant can also improve the human immune system and also be added as n diet supplement.⁵³

Immunomodulatory effects

Echinacea purpurea plant extract stimulates the functioning of the immune system such as the activation of phagocytotic activities, stimulation of fibroblast cells and increased activities of respiratory system as

a consequence of which the leukocyte mobility intensified.⁴⁹ The plant extract of *E. purpurea* enhanced the innate immunity of the organisms against the attack of pathogen by the activation of working of macrophages, natural killer (NK) cells, neutrophils and polymorphonuclear leukocytes (PMN)⁵⁴ and due to this reason this plant is widely used for the treatment of chronic pelvic infection, disease of respiratory system and wound infection.^{55,56} The immunostimulatory and anti-inflammatory activities of *E. purpurea* mainly depends on the presence of alkamides, caffeic acid derivatives, glycoproteins, ketoalkenes and polysaccharides.⁵⁴

Anti-inflammatory effects

The ethanolic extract of aerial plant parts and roots of the *Echinacea purpurea* strongly reduced the concentration of collagen proteins that is induced by fibroblast cells.⁵⁷ The extract of dried root of *E. purpurea* given to mice, effectually retarded the Carrageenan- promoted paw edema⁵⁸ and this response may be associated with the suppression of COX-1 and COX-2 by the functioning of alkamides.⁵⁹

Phytochemical constituents

The Alkamides, amides, caffeic acid derivatives and polysaccharides are the main secondary metabolites which have isolated from the plant extract of *Echinacea purpurea*. The HPLC-MS analysis strongly advocated the presence of cichoric acid and alkamide content in the plant extract.⁶⁰ The alkaloids, quercetin, kaempferol, isorhamnetin (flavonoids), heterogenous polysaccharides, p-coumaric, p-hydroxybenzoic, protocatechuic acids (phenolic compounds) polyacetylenes, arabinogalactan protein and inulin type fraction were isolated from the juicy extract of aerial plant parts.^{54,61,62}

Antioxidant properties

The free radical destroying properties of the *E. purpurea* root extract was found to be associated with the cichoric acid and phenolic contents of this plant.⁶³ The alkamide content of this plant remains inoperative against the free radicals.^{64,65} Cichoric acid acts as potent free radical scavenger and alkamides have not showed free radical destroying activities but increased the functioning of cichoric acid by regenerating the cichoric acids by donating the allylic hydrogen.^{65,66}

ACMELLA OLERACEA (L.) (TOOTHACHE PLANT)

Family: Asteraceae (Sunflower family)

Main use: Garden flower, Herbal medicine

Flowering period: August to October

Scientific Classification

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Asterales
Family	Asteraceae
Genus	<i>Acmella</i>
Species	<i>officinalis</i>

Acmella oleracea (L.) (synonyms *Spilanthes acmella* Murr. or *Spilanthes oleracea* L.) is used as garden herbal medicines the it is used traditionally for medical purpose, especially for toothache. Chewing *A. oleracea* is a memorial experience that gives a strong prickling taste to the tongue. It's a very unusual garden plant that looks pretty and is very easy to manage. It is believed to be native of Brazil, but its origin is not clear yet (flow-

ers of india.net). *Acmella* is generally regarded as annual. The stem of the plant is smooth, reddish-green and generally prostrate (25-30 cm). Leaves are ovate with toothed margin and sharp tip. Floral heads arise singly primarily with numerous yellowish-orange disc florets. The plant can flourish in acid to neutral well-drained soil that needs moderate sunlight.⁶⁷

Acmella is known for its anti-viral, anti-malarial, anthelmintic, anti-nociception, anti-bacterial, anti-hyperalgesic, anti-fungal, anti-inflammatory, insecticidal and analgesic effects. *Acmella* has other important properties also viz. diuretic, immunomodulatory, anti-oxidant, anti-hepatotoxic, aphrodisiac and vasorelaxant. *Acmella* is also used against gastrointestinal troubles, including ulcers. The decoction of root can also be used as purgative. Spilanthol is the crucial alkaloid present in the plant along with cinnamaldehyde, capsaicin, stigmasteryl-3-O-β-D-glucopyranoside allyl isothiocyanate and other trienoic-acid isobutyl amides. The plant also has vanillic acid, 3-acetylaleuritic acid, scopoletin, β-sitostenone, β-amyriester, β-caryophyllene, γ-cadinene, thymol, miricilic alcohol glycosides, germacrene, trans-isoferulic and trans-ferulic acid. The floral parts and leaves of the plant contains vitamin C, phenolic compounds, polyamines, carotenoids and peroxidase activity that constitute to anti-oxidants. *Acmella* is also effective against malaria.⁶⁸ The aqueous extract of aerial parts of *A. oleracea* showed antipyretic activity against *Saccharomyces cerevisiae* that induced pyrexia; thereby it used as a potent remedy for high fever.⁶⁹ It is used as an insecticide against the pest *Tuta absoluta*.⁷⁰

Acmella plant is an essential herbal plant that gives spicy tingling taste at once and then numb after sometimes. Along with curing toothache, the plant is also used for relaxing joint and muscle aches, improves muscle tiredness and relieve healing rashes on the legs. The pungent aftertaste may remain for an hour that is an excellent analgesic used by local people

since time immemorial. *Acmella* is used by Africans and Indian for curing throat and gum infection, liver abscess, stomatitis and malaria. In countries like Mauritius, Madagascar, India, etc., leaves of *A. oleracea* is used as a vegetable.⁷¹ The most common cultured species is commonly used in Africa and India as a traditional folk medicine to cure toothache, throat complaint, stomatitis and malaria. The pharmacological activity of *Acmella oleracea* is presented in Table 2. The usage of *Acmella oleracea* in different ethnopharmacological surveys is presented in Table 3. Whereas, the detailed analysis of root and leaf phytochemicals are presented in Table 4.

TANACETUM PARTHENIUM (L.) SCH. BIP. (FEVERFEW)

Family: Asteraceae (Sunflower family)

Main use: Garden flower, dried-flower arrangements

Flowering period: July and August

Scientific Classification

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Asterales
Family	Asteraceae
Genus	<i>Tanacetum</i>
Species	<i>parthenium</i>

Table 1: Phytochemical constituents present in the different plant parts of *C. officinalis* L.

Plant part	Phytochemicals	Active principle	References
Flowers	Coumarins	Esculetin, scopoletin, umbelliferone	Kerkach <i>et al.</i> 1986 ²⁴
	Flavonoids	Isoquercitrin, rutin, calendoflavoside	Ukiya <i>et al.</i> 2006 ¹⁷
		Quercetin, Isorhamnetin	Kurkin <i>et al.</i> 2007 ²⁵
		Isorhamnetin-3-O-β-D glycoside, Narcissin	Vidal-Ollivier <i>et al.</i> 1989 ²⁶
	Terpenoids	Calenduloside	Vecherko <i>et al.</i> 1975 ²⁷
		<i>Calendula</i> glycoside A, <i>Calendula</i> glycoside B	Ukiya <i>et al.</i> 2006 ¹⁷
Cornulacic acid acetate		Naved <i>et al.</i> 2005 ²⁸	
Erythrodiol		Wojciechowski <i>et al.</i> 197 ²⁹	
Volatile oils	Lupeol, Y -taraxasteol	Zitterl-eglseer <i>et al.</i> 1997 ¹⁵	
	Cubenol, α-cadinol, oplopanone, methyl nleate	Sabinene, limonene, α-pinene, p-cymene, nonanal, carvacrol, geraniol, nerolidol, t-muurolol, palustron	Nicoletta <i>et al.</i> 2003 ³⁰
			Khalid <i>et al.</i> 2012. ³¹
Leaves	Quinones	Phylloquinone, α-tocopherol, ubiquinone, plastoquinone	Janiszowska <i>et al.</i> 1976 ³²
Root	Terpenoid	Calenduloside B	Iatsyno <i>et al.</i> 1978 ³³

Feverfew is a perennial bushy herb that grows up to a height of 60-65 cm having pungently-scented (citrus) leaves. The plant spread rapidly and produces daisy-like inflorescence with white-coloured ray and yellow-coloured disc florets. Many cultivars of *Tanacetum* are being developed for ornamental purpose. Feverfew is very good for relieving headache. The plant is native of Eurasia but later cultivation is spread to North America, Chile and rest of the world. The plant is drought tolerant that need less moisture but good aerated loamy acidic to alkaline soil under full sun. The yellow colour of the flower also attracts lots of butterflies and hummingbirds. Leaves are yellowish-green, hairless and pinnately dissected as in *Chrysanthemum*.⁸⁴

Traditionally, feverfew is being used for treating headache, fever, common cold, diarrhoea, anaemia digestive problems, liver diseases and arthritis. *Tanacetum* has many pharmacologic properties such as anti-inflammatory, anti-cancer, anti-spasmodic, cardiogenic, as an emmenagogue and as an enema for worms. Numerous compounds have been extracted from the plants namely- canin, artemorin, santamarine, costunolide, manolialide, artemcanin, balchanin, reynosin, 3-beta-hydroxyparthenolide, secotanapartenolide B, 3-beta-hydroxycostunolide, 10-epicanin, epoxysantamarine, 8-beta hydroxyreynosin, secotanapar-

thenolide A, 83, 4-beta-epoxy-8-deoxycumambrin B -alpha-hydroxyestagiatin, 1-beta-hydroxyarbusculin, epoxyartemorin and tanaparthin-alpha-peroxide. Parthenolide is a significant alkaloid present in fewerfew along with other volatile oils viz. camphor, p-cymene, camphene, bornyl acetate α -terpineol, eugenol, α -terpinene, isobornyl 2-methyl butanoate, α -phellandrene, tricylene, γ -terpinene, myrtenal, α -thujene, ρ -cymen-8-ol, carvacrol, pinocarvone, borneol, α -pinene, trans-myrtanol acetate, chrysantheone, terpinen-4-ol, β -pinene and caryophyllene oxide and many others.^{85,86}

Tanacetum plant deserves a spot in every garden due to its daisy appearance and bright coloured flowers. It is a good bedding plant that is used in rock gardens, cottages and along borders. The plant has long traditional medicinal properties which are also being used in Christmas trees.⁸⁷

The pharmacological activity of *Tanacetum parthenium* leaf extract is presented in Table 5.

Preliminary analysis of phytochemical constituent showed the presence of Alkaloids, carbohydrates, flavonoids, saponins, steroids and terpenoids but not showed the presence of tannins.^{88,89}

Table 2: Pharmacological activity of *Acmella oleracea* (L.) R.K. Jansen.

Pharmacological action	Plant part utilized	Experimentation model	Experimental animal	References
Anaesthetic	Whole plant	Plexus anaesthesia in frog	Frog	Narayana et al. ⁷²
Antipyretic action	Whole plant	Yeast induced pyrexia	Albino rat	Narayana et al. ⁷²
Anti-inflammatory activity	Whole plant	Carrageenan activated paw oedema	Albino rat	Ratansooriya et al. 2004 ⁷³ Wu et al. 2008 ⁷⁴
Anti-fungal activity	Flowers	-	-	Moreira et al. 1989 ⁷⁵
Diuretic activity	Flowers and whole plant	induction of diuresis (cold water extract)	Albino rat	Peiris et al. 2001; ⁷⁶ Mondal et al. 1998 ⁷⁷
Anti-oxidant activity	Leaves and whole plant	SOD and DPPH method	<i>In-vitro</i> , no animal used	Ahmed et al. 2004; ⁷⁸ Wu et al. 2008 ⁷⁴
Antimalarial and larvicidal activity	Spilanthal (extracted from the entire plant)	-	Egg and pupae of vector	Saraf and Dixit 2002 ⁷⁹
Immunomodulatory effect	Whole plant	-	Mice	Sharma et al. 2012 ⁸⁰

Table 3: Usage of *Acmella oleracea* in different ethnopharmacological surveys.

Country/ Geographic Area	Plant part	Utilization	References
Bangladesh	Leaves and Flowers	Headache, toothache, muscle pain, cough,	Tiwari et al. 2011 ⁸¹
Brazil	Leaves	Against alcoholic hangover	Dubey et al. 2013 ⁶⁸
India	Leaves and Flowers	Antitoothache and throat infection, insecticidal, Gastro-intestinal disorders	Pathak, K. 2013 ⁸²
Indonesia	Whole plant	Anticancerous agent	Reshmi and Rajalakshmi, 2016 ⁸³
Sri Lanka	Flower extract	Stimulate salivary gland tissues	Paulraj et al. 2013 ⁶⁷

Table 4: Analysis of phytochemical constituents from aqueous extract of leaf and root of *Acmella oleracea* (L.) R.K. Jansen.

Phytochemical	Aqueous extract of leaf	Aqueous extract of root
Alkaloids	present	present
Amino acids	absent	absent
Carbohydrate	present	present
Carotenoids	present	absent
Flavonoids	absent	absent
Glycosides	absent	absent
Steroids	absent	absent
Tannins	present	present

Table 5: Analysis of phytochemical constituents from aqueous and ethanolic leaf extracts of *Tanacetum parthenium*.

Phytochemicals	Aqueous extract of leaf	Ethanolic extract of leaf
Alkaloids(Mayers/Wagner's/ Dragendorff reagent)	present	present
Carbohydrate(Fehlings+ Benedict's test)	present	present
Flavonoids	present	present
Saponins	present	present
Steroids (Liebermann's / Salkowski test)	present	present
Tannins	absent	absent
Terpenoids	present	present

Anti-inflammatory activities

Genus *Tanacetum* act as an inhibitor of prostaglandin biosynthesis. The aerial plant extract retarded the production of prostaglandin. Sesquiterpene lactones, abundantly present in chloroform leafy extract of this plant and significantly decreased the biosynthesis of prostaglandins in mice and human being. The lipophilic compounds found to be associated with the anti-inflammatory function as it retarded the oxidative activities of neutrophil cells of the human being.⁹⁰⁻⁹² A lipophilic flavonoid (obtained from leaf, flower and seeds of this plant) called as Tanetin, inhibit the production of prostaglandin.

Chemotherapeutic effect and anticancerous effect

Parthenolide (a sesquiterpene lactone of feverfew) retarded the growth and development of bacteria, yeast and the various filamentous fungi⁹³ and also act as a significant inhibitor of *Mycobacterium tuberculosis* and *M. avium*.⁹⁴ The lactone compounds, more importantly, parthenolide exhibited the anticancerous effectivity and significantly reduced the functioning of fibroblast cells, laryngeal carcinoma, epidermoid cancer of the nasopharyngeal cavity of human being, also retarded the anti-Epstein-Barr early antigen function.⁹⁵⁻⁹⁷

CONCLUSION

We can conclude that there is a number of ornamental plants which be used both as decoration and medical purpose as the majority of them are having antioxidant activity and can be taken in many types of beverages. Flowers of many ornamental plants are used in cooking having essential oil and alkaloids, which add a different flavour to the food. Several ornamental plants can be used as indoor plants for the removal of toxic compounds in the air inside the home, hospitals, etc. Many flowers and leaves of ornamental plants are eaten as raw in salads or can be used as garnishing curry. Many flowers like lavender, rose, chamomile, hibiscus, etc. are having sweet fragrance and can be used in perfumes, soaps, oils, etc. Many ornamental plants are being used local people for making of syrups or juices or teas for getting anti-oxidants directly from the plants. Many nurseries are promoting to sell their hybrid varieties which can serve both purposes ornamental as well as medicinal. It can be suggested that we should grow some amount of ornamental plants in our surroundings to make it pleasant and to feel calmness. There are so many plants which can be consumed directly but their right properties and quantity should be known. As they are devoid of any side-effects so can be used easily by the general public. There are lots of magic hidden in

flowers which have to be discovered yet. Future prospective of growing these ornamental plants can be vast as they not only serve an ornamental purpose but also used for commercial medicinal purpose.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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