

A REVIEW ON PHYTOCHEMICAL & PHARMACOLOGICAL STUDY OF *TANACETUM PARTHENIUM* L.

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ABSTRACT

Feverfew is the scientific name *Tanacetum Parthenium* L. belonging to family Asteraceae is a medicinal plant and used for the treatment of migraine, rheumatoid arthritis, toothache, fever, stomach ache, infertility, insect bites and hindrances with menstruation and labor during childbirth. The feverfew plant herb has a long history of use in modern medicine and widespread medicine, especially among Greek word and early European herbalists. Feverfew has been used for asthma, dizziness, psoriasis, nausea, vomiting and tinnitus. The plant contains large number of natural product but active principle includes one or more of the sesquiterpene lactone known to be present, including parthinolides and Flavonoid glycoside contains apigenine, pinenes. It has different pharmacological activities such as anticancer,

anti-inflammatory, anticoagulant, anti-fibrinolytic activities and anti-anthelmintic activity. In review, we've action taken the various measurement of the feverfew plant and complied its vast pharmacological uses to comprehend and synthesis the subject of its implicit image of multipurpose medicinal agents. The fever few plant is extensively cultivated to large regions of the world and its significance as medicinal plant is growing mainly with adding and storages reports in support of its multifarious pharmacological uses.

KEYWORDS: Feverfew plant, Phytochemicals, Sesquiterpene, Pyrethrin, Pharmacological Activities.

INTRODUCTION

Feverfew (*Tanacetum parthenium* L.) belonging to the family Asteraceae (daisies) is a daisy-like perennial plant found commonly in gardens and along roadsides. The name stems from

the Latin word *febrifugia*, “fever reducer.” The first-century Greek physician Dioscorides prescribed feverfew for “all hot inflammations.” Also known as “featherfew,” because of its feathery leaves.^[1-3] It is a short, bushy, aromatic perennial that grows 0.3-1 m in height. Its yellow-green leaves are usually less than 8 cm in length, almost hairless, and pinnate–bipinnate (chrysanthemum like). Its yellow flowers bloom from July to October, are about 2 cm in diameter. They resemble those of chamomile (*Matricaria chamomilla*), for which they are sometimes confused, and have a single layer of white outer-ray florets.^[1-3] This aromatic plant gives off a strong and bitter odor. Its yellow-green leaves are alternate (in other words the leaves grow on both sides of the stem at alternating levels), and turn downward with short hairs. The small, daisy-like yellow flowers are arranged in a dense flat-topped cluster [Figure1]. This plant has been investigated mainly for its traditional uses in medicine, such as treatment of fever, headache, migraine, stomachache, insect bites, bronchitis, arthritis, cold, abortifacient property and menstruation-related problems.^[4]

Previous studies on the antimicrobial properties of plants from Asteraceae family have shown that their antimicrobial activity is moderate to strong. Saharkhizet all reported antimicrobial activity of feverfew against some bacteria.^[5]

Pareeket all reported that feverfew has been used for psoriasis, allergies, asthma, tinnitus, dizziness and vomiting.^[6]



Figure 1: Feverfew (*Tanacetum parthenium*): whole plant (a), flower (b), and feathery leaves (c).

COMMON NAME

Chrysanthemum parthenium, Feverfew, featherfew, altamisa, bachelor's button, feather foil, febrifuge plant, midsummer daisy, nosebleed, Santa Maria, wild chamomile, wild quinine, chamomile grande, chrysanthemum atricaire, federfoy, flirtwort, *Leucanthemum parthenium*, *Matricaria capensis*, *Matricaria eximia* hort, *Matricaria parthenium* L., MIG-99, mother

herb, *Parthenium hysterophorus*, parthenolide, *Pyrethrum parthenium* L, European feverfew, featherfully, feddygen fenyw, flirtroot, grande chamomile, mutterkraut, and vetter-voo.^[7-11]

The common name of the plant "feverfew" is indeed "feverfew." The scientific name for feverfew is *Tanacetum parthenium*. It is a medicinal herb that is often used for its potential anti-inflammatory and pain-relieving properties, as well as for the treatment of migraines and other headaches.

BOTANICAL CLASSIFICATION

Kingdom	: Plantae (Plants)
Subkingdom	: Trachiobionta (Vascular plants)
Super division	: Spermatophyta (Seed plants)
Division	: Mangliophyta (Flowering plants)
Class	: Magnoliopsida (Dicotyledons)
Subclass	: Asteridae
Order	: Asterales
Family	: Asteraceae (Aster family)
Genus	: <i>Tanacetum</i> (tansy)
Species	: <i>Tanacetum parthenium</i> (feverfew)

HABITAT

Native to the Balkan Peninsula, feverfew is now found in Australia, Europe, China, Japan, and North Africa. In the mid-19th century, feverfew was introduced in the United States. The plant grows along roadsides, fields, waste areas, and along the borders of woods from eastern Canada to Maryland and westward to Missouri.

HISTORY

Historically, the plant has been placed into 5 different genera, thus some controversy exists as to which genus the plant belongs. Former botanical names include: *Chrysanthemum parthenium* (L.) Bernh., *Leucanthemum parthenium* (L.) Gren and Gordon, *Pyrethrum parthenium* (L.) Bernh., and *Matricaria parthenium* (L.).

It has been alternately described as a member of the genus *Matricaria*.^[2,12]

The ancient Greeks called the herb "Parthenium," supposedly because it was used medicinally to save the life of someone who had fallen from the Parthenon during its

construction in the 5th century BC. The first-century Greek physician Dioscorides used feverfew as an antipyretic. Feverfew also was known as “medieval aspirin” or the “aspirin” of the 18th century.^[2,13] In Central and South America, the plant has been used to treat a variety of disorders. The Kallaway Indians of the Andes mountains value its use for treating colic, kidney pain, morning sickness, and stomach ache. Costa Ricans use a decoction of the herb to aid digestion, as a cardiostonic, an emmenagogue, and as an enema for worms. In Mexico, it is used as an antispasmodic and as a tonic to regulate menstruation. In Venezuela, it is used for treating earaches.^[2] The leaves are ingested fresh or dried, with a typical daily dose of 2–3 leaves. The bitterness is often sweetened before ingestion. Feverfew also has been planted around houses to purify the air because of its strong, lasting odor, and a tincture of its blossoms is used as an insect repellent and balm for bites.^[14] It has been used as an antidote for overindulgence in opium.^[15]

PHYTOCHEMICAL STUDY

Potentially active chemical components of feverfew are as follows

- 1- Sesquiterpene lactones: parthenolides, canin, artemisin, santamarin;
- 2- Flavonoid glycosides: luteolin, rutin, apigenin, 6-hydroxy-flavonols;
- 3- Sesquiterpenes and monoterpenes: camphor, borneol, germacrene and pinenes; and
- 4- Other components including polyacetylenes, pyrethrin, melatonin and tannins.^[16]

Sesquiterpene Lactone

Parthenolide is the most abundant sesquiterpene lactone and is considered the most active chemical component in feverfew.^[17]

Sesquiterpene lactones More than 30 sesquiterpene lactones have been identified in feverfew. In general, there are 5 different types of sesquiterpene lactones, which may be classified by chemical ring structures. Feverfew contains eudesmanolides, germacranolides, and guaianolides. Parthenolide is a germacranolide.^[2] Researchers have also isolated the following sesquiterpene lactones: artemisin, artemisin, balchanin, canin, costunolide, 10-epicanin, epoxyartemisin, 1-beta-hydroxyartemisin, 3-beta-hydroxycostunolide, 8-alpha-hydroxyestragatin, 8-beta-hydroxyreynosin, 3-beta-hydroxyparthenolide, manolialide, reynosin, santamarin, epoxysantamarin, secotanaparthanolide A, secotanaparthanolide B, tanaparthin-alpha-peroxide, and 3,4-betaepoxy-8-deoxycumambrin B.^[13] Other members of this class have been isolated and possess spasmolytic activity, perhaps through an inhibition of the influx of extracellular calcium into vascular smooth muscle cells.^[2,18,19] [Figure 1].

Flavonoids

Flavonoids Lipophilic flavonoids in the leaf and flower of feverfew have been identified as methyl ethers of the flavonols 6-hydroxykaempferol and quercetagenin. Two flavone glucuronides and apigenin are found in glandular trichomes on the flowers' lower epidermis.^[40]

Volatile Oils

Volatile oils Twenty-three compounds, comprising 90% of the volatile oils, have been identified in feverfew. The main components include camphor (56.9%), camphene (12.7%), Pcymene (5.2%) and Bornyl acetate (4.6%).^[20]

Other Chemical Components

Coumarin, isofraxidin and isofraxidin drimenyl ether (9-epipectachol B) have been isolated from the roots of the plant.^[21,22]

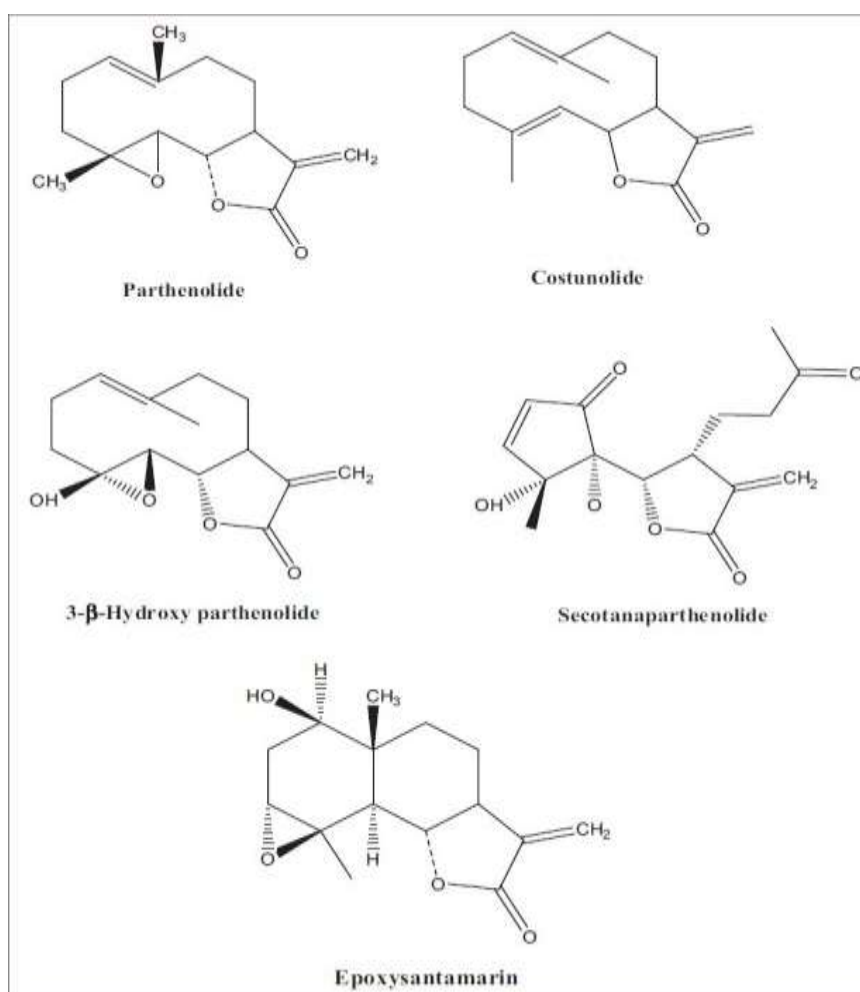


Figure 1: Sesquiterpene lactones of *Tanacetum parthenium*.

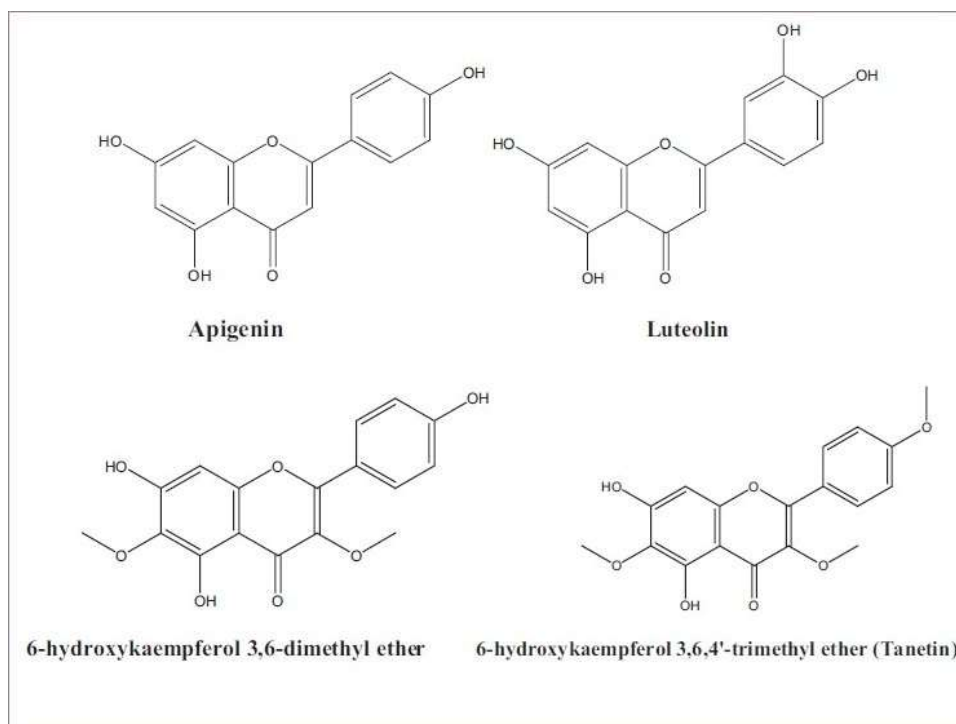


Figure 2: Flavonoids of *Tanacetum parthenium*.

Uses

Feverfew has been used as herbal drug to relieve fever and to treat headaches, arthritis and digestive problems.

PHARMACOLOGICAL ACTIVITY OF FEVERFEW PLANT

1. Anticancer activity

Mechanisms of action may include cytotoxic action associated with interruption of DNA replication by the highly reactive lactone ring, epoxide, and methylene groups of parthenolide through inhibition of thymidine into DNA; oxidative stress, intracellular thiol depletion, endoplasmic reticulum stress, and mitochondrial dysfunction.^[2,23,24] Parthenolide and similar lactones displayed anticancer activity against several human cancer cell lines, including human fibroblasts, human laryngeal carcinoma, human cells transformed with simian virus, human epidermoid cancer of the nasopharynx, and anti-Epstein–Barr early antigen activity. One study documents how parthenolide may influence and enhance the effectiveness of paclitaxel.^[25-27]

2. Anticoagulant and Antifibrinolytic Activities

Chloroform extracts, water extracts, and essential oils of *T. cilicium*^[28], *T. corymbosum*^[29] and *T. macrophyllum*^[30] were examined for their anticoagulant activity by the prothrombin

time (PT), thrombin time (TT) and partial thromboplastin time (PTT) tests; and antifibrinolytic activity by the euglobulin lysis time (ELT) test. All extracts were found to exhibit remarkable anticoagulant activity as well as antifibrinolytic activity. Both the clotting time and the euglobulin lysis time have been prolonged by the addition of plant extracts. These two activities are related with the antiinflammatory activity. Thus, these extracts possessing anticoagulant and antifibrinolytic activities may be partly responsible for the antiinflammatory activity.

3. Antihelmintic Activity

Lonescu et al exhibited that *T. vulgare* showed antihelmintic activity. Ether extract, essential oils and P-thujone isolated from *T. vulgare* were found as active principles and toxic doses were recorded.^[31]

4. Migraine headache and prophylactic treatment

Feverfew activity does not seem to be exerted through a single mechanism. The plant extract affects a wide variety of physiologic pathways, some of which have been already discussed, such as decrease in vascular smooth muscle spasm, inhibition of prostaglandin synthesis and blockage of platelet granule secretion.^[32]

CONCLUSION

Feverfew is the scientific name *Tanacetum Parthenium* L. belonging to family Asteraceae is a medicinal plant and used for the treatment of migraine, rheumatoid arthritis, toothache, fever, with menstruation and labor during childbirth. Fever few contains many sesquiterpene lactones, with higher concentration of parthenolide lipophilic and glacial flavonoids in the leaves and the flower heads.

Feverfew also use as spasmolytic in colic, colitis and gripping, and as vermifuge and purgative. The uterine stimulant effect of the plant decided with the common uses of the plant as abortifacient and in certain labor difficulties and also agreed with the warning of the drug producer, which indicates the prevention of using feverfew during pregnancy but not agree with the widespread use of the drug in threatened miscarriage.

Taking great worry of the useful benefits of the plant, it can be encouraged as a safe, highly important, medicinal plant for general manhood.

REFERENCES

1. Castleman M. The Healing Herbs. Emmaus, PA: Rodale Press, 1991.
2. Chavez M, Chavez P. Feverfew. *Hosp Pharm.*, 1999; 34: 436-61.
3. Jain NK, Kulkarni SK. Antinociceptive and anti-inflammatory effects of *Tanacetum parthenium* L. extract in mice and rats. *J Ethnopharmacol*, 1999; 68: 251-9.
4. Evans WC. Trease and Evans Pharmacognosy. 15th ed. London: WB Saunders Co Ltd, 2001.
5. Saharkhiz MJ, Omidbaigi R, Sefidkon F. The effect of phosphorus and irrigation treatment on the essential oil content and composition of feverfew (*Tanacetum parthenium* L. cv. Zardband). *Journal of Essential Oil Bearing Plant.*, 2007; 10(5): 391-398.
6. Pareek A, Suthar M, Rathore G, Bansol V. Feverfew: A systematic review. *Pharmacogn Rev.*, 2011; 5(9): 103- 110.
7. Duke JA. CRC Handbook of Medicinal Herbs. Boca Raton, FL: CRC Press, 1985.
8. Jackson B, McDonald RL. In: Dobelis IN, editor. Magic and Medicine of Plants. Pleasantville, NY: Reader's Digest Assoc., 1986.
9. Meyer JE. The Herbalist. Hammond, IN: Hammond Book Co., 1934.
10. Castleman M. The Healing Herbs. Emmaus, PA: Rodale Press, 1991.
11. Chavez M, Chavez P. Feverfew. *Hosp Pharm.*, 1999; 34: 436-61.
12. Heptinstall S, Awang DW, Dawson BA, Kindack D, Knight DW. Parthenolide Content and Bioactivity of Feverfew (*Tanacetum parthenium* (L.) Schultz-Bip.). Estimation of Commercial and Authenticated Feverfew Products. *J Pharm Pharmacol*, 1992; 44: 391-5.
13. Setty AR, Sigal AH. Herbal medications commonly used in the practice of rheumatology: Mechanisms of action, efficacy, and side effects. *Semin Arthritis Rheum*, 2005; 34: 773-84.
14. Jackson B, McDonald RL. In: Dobelis IN, editor. Magic and Medicine of Plants. Pleasantville, NY: Reader's Digest Assoc., 1986.
15. Duke JA. CRC Handbook of Medicinal Herbs. Boca Raton, FL: CRC Press, 1985.
16. Krimavi H, Rakhshandeh H, Esmaili H. Effect of *Tanacetum parthenium* for treatment of migraine. *Medicinal Journal of Mashhad University of Medical Sciences*, 2007; 50(97): 333-338.
17. Groenewegen WA, Knight DW, Heptinstall S. Progress in the medicinal chemistry of the herb feverfew. *Prog Med Chem.*, 1992; 29: 217-238.

18. Begley M, Hewlett M, Knight D. Revised structures for guaianolidemethylenebutyrolactones from feverfew. *Phytochemistry*, 1989; 28: 940-3.
19. Groenewegen WA, Knight DW, Heptinstall S. Compounds extracted from feverfew that have anti-secretory activity contain an alpha-methylene butyrolactone unit. *J Pharm Pharmacol*, 1986; 38: 709-12.
20. Williams CA, Hoult JR, Harborne JB, Greenham J, Eagles J. A biological active lipophilic flavonol from *Tanacetum parthenium*. *Phytochemistry*, 2007; 38: 267-270.
21. Kisiel W, Stojakowska A. Sesquiterpene coumarin ether from transformed roots of *Tanacetum parthenium*. *Phytochemistry*, 2007; 46: 515-516.
22. Laiking S, Brown G. Coniferaldehyde derivatives from tissue culture of *Artemisia annua* and *Tanacetum parthenium*. *Phytochemistry*, 1999; 50: 781-785.
23. Zhang S, Ong CN, Shen SM. Critical roles of intracellular thiols and calcium in parthenolide-induced apoptosis in human colorectal cancer cells. *Cancer Lett.*, 2004; 208: 143-53.
24. Zhang S, Ong CN, Shen HM. Involvement of proapoptotic Bcl-2 family members in parthenolide-induced mitochondrial dysfunction and apoptosis. *Cancer Lett.*, 2004; 211: 175-88.
25. Ross JJ, Arnason JT, Birnboim HC. Low concentrations of the feverfew component parthenolide inhibit in vitro growth of tumor lines in a cytostatic fashion. *Planta Med.*, 1999; 65: 126-9.
26. Miglietta A, Bozzo F, Gabriel L, Bocca C. Microtubule-interfering activity of parthenolide. *Chem Biol Interact*, 2004; 149: 165-73.
27. Kapadia GJ, Azuine MA, Tokuda H, Hang E, Mukainaka T, Nishino H, et al. Inhibitory effect of herbal remedies on 12-O-tetradecanoylphorbol-13-acetate-promoted Epstein-Barr virus early antigen activation. *Pharmacol Res.*, 2002; 45: 213-20.
28. Thomas, O.O. *Fitoterapia*, 1989; UT(2): 138.
29. Thomas, O.O. *Fitoterapia*, 1989; LX(3): 231.
30. Thomas, O.O. *Fitoterapia*, 1989; ZJT(4): 329.
31. Ionescu, C.N.; Anitescu, C; Lungu, W.; El. Stoican *Commun. Acad. Rep. Populare Romine*, 1958; 8: 2794.
32. Pareek A, Suthar M, Rathore G, Bansol V. Feverfew: A systematic review. *Pharmacogn Rev.*, 2011; 5(9): 103-110.