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Biological & Immunological significance of Tanacetum balsamita: A Review

Priya[1], Prashant Kumar Dhakad[1*], Rakesh Gupta[1], Aziz Ahmed[1]
[1]*Jaipur College of Pharmacy, ISI-15,Riico Institutional Area, Sitapura Tonk Road, Jaipur -302022 (Raj.), India*

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ABSTRACT: There are 160 recognized species of Tanacetum flowers that are native to temperate climates all over the world, but especially in the Northern Hemisphere, the Mediterranean Basin, and parts of southwestern and eastern Asia. Indigenous people throughout the world have used Tanacetum species for generations in their traditional medicinal practices. These plants also have countless uses in traditional cooking, cosmetics, and farming. Several online scientific engines were systematically searched for current information about the genus Tanacetum, including PubMed, Web of Science, Scopus, SciFinder, Wiley Online, Science Direct, and the Cochrane library. The data was pertaining to traditional uses, phytochemistry, biological activities, toxicity, and clinical trials. Phenolic acids, flavonoids, coumarins, fatty acids, aldehydes, volatile chemicals, naphthoquinones, and a total of 241 metabolites have been identified from around 20 species throughout the last 30 years. Several species' sesquiterpene lactones, pyrethrins from Tanacetum cinerariifolium, and ceramides tanacetamide (A-D) from Tanacetum artemisioides are among the unique metabolites that have been discovered. Despite several in vitro indications of these secondary metabolites' enormous pharmacological activities, particularly as hypotensive, neuroprotective, anticancer, and antibacterial agents, they have received surprisingly little attention from researchers. Traditional uses of the plant for things like treating diabetes, cancer, worms, and other illnesses have been backed up by modern science. The plant also has antioxidant, hepatoprotective, insecticidal, and anti-cancer properties. Future study should focus on validating its additional ethnomedicinal applications, which include its potential as a litholytic, antivenom, diaphoretic, and treatment for rheumatism, anemia, arthritis, and gout.

KEYWORDS: Tanacetum, ethnopharmacology, ceramides, sesquiterpene lactones, traditional use

I. INTRODUCTION

Tanacetum species, which are members of the Asteraceae family, have a rich history of traditional use in many areas, including as cosmetics, medicine, agriculture, and food. An assortment of medical issues, including diabetes, migraines, cholecystitis, dyspepsia, nausea, diarrhea, hypertension, gastrointestinal issues (including bloating and discomfort), ringworms, and STDs, have been addressed through its ethnopharmacological usage [1]. Due to their spicy scent and minty balsam perfume, a handful of taxa, most notably T. balsamita (Costmary), are still valued in the traditional cuisine of several nations, particularly Italy [2,3]. To provide just a few examples, you may steep rosemary leaves for a herbal tea, add their aromatic qualities to omelets, soups, meats, salads, and vegetable pies, and even use them as a skin soothing and scent ingredient (3,4). Before the chemistry of active metabolites came into play, the dried and blended flowers of T. cinerariifolium were utilized in agriculture for a long time to repel flying insects and fend off body lice and fleas [5]. The genus Tanacetum has been the subject of over 240 secondary metabolites discovered in recent phytochemical studies. These substances include volatile compounds, phenolic acids, flavonoids, fatty acids and alkanes, aldehydes, and coumarins [6,7]. The leaves, roots, and whole plants of T. vulgare and T. densum also include certain nutrients that are good for you, such carbs and vitamins [8].

Taxonomy, geographical distribution of Tanacetum spp

Following the two rich-species genera Artemisia L. (522 species) and Anthemis L. (177 species), the Asteraceae family's Tanacetum L. is

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the third biggest genus of the chamomile tribe Compositae-Anthemideae, with around 160 species of flowering plants [9]. Tanacetum species have 553 registered names, with 179 recognized names, 206 synonyms, and 168 unresolved names (The Plant List, accessed on: 13 September 2022), and 189 subordinate taxa are included in the worldflora online database. Tanacetum species are found in temperate zones all over the world, but notably in the Mediterranean Basin, northern America, and areas of southwestern and eastern Asia (Turkey, Azerbaijan, Iran, and Armenia). Note that this genus encompasses a wide range of plant forms, from subshrubs to perennial herbs, and that the capitula can be either radiating or clustered in loose to dense corymbs, with shapes ranging from disciform to discoid [9]. Within this medium-sized tribe, there is ongoing controversy on the infrageneric classification of the genus Tanacetum due to its complicated taxonomical history, phylogenetic position, and morphological intraspecific variety [9]. As an example, prior research suggested a subtribal categorization of the tribe based mostly on physical features, but subsequent molecular-phylogenetic investigations found that this classification was significantly polyphyletic [11]. Afterwards, molecular-phylogenetic studies have moved certain species from Tanacetum to other Anthemidinae genera around the Mediterranean, including Nananthea, Anthemis, Cota, and Tripleurospermum [9].

Morphological features of Tanacetum spp

Because tansies were traditionally intercropped with coffin liners to keep rodents at bay, the Latin generic name Tanacetum appears to have originated from the word Athanasia, meaning "eternal life and immortality" in botanical contexts. A small number of tansies are evergreens, sub-shrubs, herbaceous perennials, or annuals, while the majority of tansies are perennial herbs. The leaf of Tanacetum plants can be hairy, occasionally silvery, and intensely fragrant. Species in this family range in height from only a few centimeters (5 cm) to an impressive 150 cm. Blades can be either obovate or spatulate, and the leaves can be sessile, petiolate, basal and cauline, or alternating. The blooms, which can be either flat or hemispherical in appearance, are surrounded by many layers of phyllaries at the base. Worldwide, research has identified three main Tanacetum taxa—T. vulgare, T. balsamita, and T. parthenium—that are utilized in ethnomedicinal practices. These fruits, which are cypselas with ribs and glands, usually endowed with a pappus [12]. The most common components, however, are the leaves (45.31 percent), flowers (18.76 percent), and aerial parts (15.63 percent). Native mountain peoples would drink a mixture of crushed and cooked roots (Pleurospermum and Tanacetum spp.) three or four times a day for the treatment of gastritis and stomachaches according to Ayurvedic medicine. In addition to washing, chopping, and chewing the subterranean components for fever and arthritis, they are also used topically.

II. IMMUNE SYSTEM

In protecting against harmful infections and keeping the body at a steady temperature, the immune system plays a crucial function. One legitimate and intentional way to keep things in check is to mount a sufficient immune response whenever danger is detected (13). Nevertheless, a hyperactive immune system, when left unchecked, can cause a domino effect of negative consequences and is strongly linked to the onset of several illnesses (14, 15). Both persistent inflammation and the development of autoimmune illnesses, in which the immune system mistakenly targets certain cells, are potential causes of these conditions. The worsening of illness and patient condition is undeniably caused by the advancement of inflammation. There is mounting evidence that chronic inflammation—as shown by elevated levels of proinflammatory cytokines—is a pathophysiological component of numerous diseases. This includes not only respiratory illnesses like asthma and rheumatoid arthritis but also gastrointestinal ones like heart disease, liver disease, and even the most common neurological disorders like schizophrenia, epilepsy, depression, and Alzheimer's. Consequently, it is reasonable to externally dampen the immune response. Pharmacokinetic and pharmacodynamic advancements in immunomodulation indicate that it is a promising subfield. Attenuation of pharmacological therapy side effects or toxicity in novel approaches are just two of the numerous challenges that must be overcome (16, 17). But immunomodulation has been a success in clinical settings (18, 19). The immune system is an intricate network of interdependent parts that works to defend the body against outside invaders (20). It consists of genes, chemicals, cells, and organs.

Innate Immune Response

Protecting oneself from harmful microbes begins with innate immunity. Though it reacts

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quickly, this type of immune response is not selective and does not create immunological memory. Phagocytosis is a process that includes epithelial barriers and myeloid cells (such as neutrophils, dendritic cells, monocytes in the blood, and macrophages in tissues). In addition to NK cells, tissue resident immune cells, and the complement system, the innate immune response also includes these entities (21).

Adaptive Immunity

Lymphocytes, namely T cells and B cells, play a critical role in adaptive immunity. It offers a broad range of antigens long-term protection through clonal responses that are quite selective. Because it develops immunological memory and self-reactivity, the adaptive immune response rapidly diminishes once the infection is eradicated.

Cell-mediated immunity

When regulatory T helper 1 (Th1) cells activate antigen-presenting cells (APCs) and cytotoxic T-cells, this process is known as cell-mediated immunity. Viral, bacterial, fungal, and protozoan infections all trigger this immunological response.

Humoral response

The specific adaptive immune response that Th2 cells stimulate, leading to the generation of B cells and antibodies, is known as humoral immunity. Extracellular pathogens, including as yeasts, bacteria, protozoa, and parasites, are the targets of this immune response. Additionally, intracellular infections can be bolstered by this immune response (22).

Inflammatory Response

Innate immune system function drives inflammation. Initial inflammatory symptoms include vasodilation and increased blood flow. This causes erythema and inflammation-related heat. Inflammatory cells from blood flow into tissue cause edema and swelling due to increased vascular permeability. Bradykinins and prostaglandins promote pain sensitivity and hyperalgesia (23). Immunomodulatory drugs decrease or increase the immune system's response to antigens. Many formulations of immunomodulatory plant items are available to boost the immune system (24). Costmary is a fragrant perennial plant with rhizomes used in cooking and medicine. It was once common in herb gardens. It seems out of style. The herb is 3-6 feet tall and smells balsamic. Yellow, button-like blooms emerge from September to October. Costmary is an Aster.

The plant comes from Southern Europe and Western Asia. Between the 16-18th century, Costmary was a diuretic, laxative, and antipyretic in Europe. The plant was utilized in potpourri and lavender-scented bedding bundles.

Tanacetum comes from the Greek word "Athanasia," meaning "immortal." Balasamita comes from "balsamum," "an aromatic resin used for wound healing and pain relief." Plants have several common names. Costmary comes from Costus, an Asian spice and preserve plant. "Mary" may refer to the Virgin Mary and the plant used as a herb to ease childbirth pain in Medieval times. Also known as Bible Leaf or Bible Plant. Some American colonists used long balsam-scented leaves as Bible bookmarks. To keep parishioners attentive during sermons, fragrant leaves were stuffed into their Bibles. The English employed the plant to flavor their ales, thus Alecost (25).

III. CHEMICAL CONSTITUENTS

The major constituents of the leaf oil were bornyl acetate (47.7%), pinocarvone (27.1%), camphor (9.3%) and terpinolene (5.4%), while the fower oil contained bornyl acetate (55.2%), pinocarvone (34.2%), camphor (2.8%) and terpinolene (2.0%) and the stem oil contained bornyl actate (49.2%), pinocarvone (28%), camphor (9.5%) and terpinolene (6%) (17).

IV. BIOLOGICAL USES

T. parthenium extract suppresses platelet aggregation, mast cell histamine release, and prostaglandin, thromboxane, and leukotriene formation, making it an efficient migraine preventative.

Iranian traditional medicine treats inflammation, infection, and urinary tract issues using Tanacetum sp. oil. Food manufacturers can employ Shahesparam in addition to its therapeutic uses. Tea made from T. sonboli is used to alleviate diarrhea in Iran. In addition, Tanacetum microphyllum and T. larvatum can cure inflammatory illnesses and prevent indomethacin-induced ulcerogenesis (26).

In Southern Europe, costmary leaf decoctions were used to repel livestock and children and kill insects. Costmary was also used to mask home smells and freshen closets. Fra' Angiolo Marchissi created a water concoction with Ceylon cinnamon, rosemary, and mint in 1614 influenced by costmary's balsamic smell. Coughs, colds, and relaxation were

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treated with this mixture. Thus, this distilled solution was called "Anti-hysteric Water". The widespread use of hop (Humulus lupulus) in the 15th century caused costmary to diminish as a beer flavoring. They sometimes used fresh aerial pieces bathed in hot water to treat serious wounds and furuncles. The Persian pharmacopeia uses costmary leaves and flowerheads in decoction, infusion, and floral water as a general tonic, antiallergic, anticancer, hepatoprotective, sedative, flatulent, and cardiotonic, while Serbia uses the leaves' tea to treat migraines and menopause issues. Additionally, the leaf and stem decoction was administered topically as a rheumatism ointment, antipyretic, and menstruation regulator. On June 21, the indigenous people of Northern Istria inhaled T. balsamita burned leaves with rose petals and wormwood for relaxation. Southern Italians used costmary leaf infusions for bile insufficiency, cholecystitis, nervous dyspepsia, sedation, antispasmodic, anti-inflammatory, and anti-insomnia. Turkish traditional medicine prescribes two teacups of T. balsamita leaf infusion thrice day for three weeks to treat diabetes.

V. CONCLUSION

This review found that Tanacetum has been ethnopharmacologically utilized to treat arthritis, fever, hypertension, nausea, renal difficulties, dyspepsia, stomach discomfort and bloating, diabetes, festering wounds, flu and cold, and migraine. Pharmacological investigations have validated its large traditional usage as an anthelmintic, antidiabetic, anticancer, antioxidant, insecticide, hepatoprotective, and skin ulcer, festering wound, urinary tract infection, and sexually transmitted disease treatment.

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