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Exploring phytochemical potential of nature's bliss *Thymus vulgaris* L. Mini review

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Abstract
Thymus vulgaris L. is also known as Thyme, Pahari Podina, Mountain Thyme, Creeping Thyme and Wild Thyme, has been explored for its phytochemical potential against oxidation and microbial activity. Thyme is a general name. It has more than 300 species, varieties, hybrids and ecotypes. A polymorphic variation as the intraspecific chemotype variation character is present and is common in the genus Thymus. This study helps the researcher in future to reflecting potential of thyme as antifungal, antioxidant and anti-microbial agent along with supporting experimental studies.

Keywords: antifungal, anti-microbial, antioxidant, thyme, phytochemical

1. Introduction

Phytocomponents as phenolics, antimicrobials, vitamins, flavonoids, dietary fiber and neuropharmacological agents play a basic role in the prevention and cure of many chronic diseases like obesity, diabetes, cardiovascular, cancer and de-generative disorders (Siddhuraju and Becker, 2007) [31]. Nowadays, the synthetic food additives are utilized blindly which have serious health consequences on health (Paradiso *et al*., 2008) [26]. Natural food products attaining extra attention for safety, drug interaction and effectiveness. Scientific evidences showing many types of nutraceutical and pharmacological activities of many types of plants (Celiktas *et al.,* 2007) [12]. *Thymus vulgaris* L. is also known as Thyme, Pahari Podina, Mountain Thyme, Creeping Thyme and Wild Thyme. It has strong and spicy taste (Beer *et al*., 2007) [8]. Across the globe, use of aromatic and medicinal plants is increasing. Pahari Podina (*Thymus vulgaris* L.) which belongs to Lamiaceae family is rich source of phytochemicals and bioactive compounds (Shan *et al*., 2005) [30]. Thyme is like a shrub, reaches height of 30-50cm having woody stems. In Mediterranean region, it is known as typical plant (Mendivil *et al*., 2006) [25]. Two active components of *Thymus vulgaris* L. are Thymol (5-methyl-1-2-isopropyl phenol) and Carvacrol (5-isopropyl-2-methyl phenol) (Faizi and Nazeri, 2011) [16]. It is extensively cultivated in US and Europe for culinary use (Beer *et al*., 2007) [8]. Its cultivation seasons are relatively hot Summers and mild Winter with the condition of full sun exposure. It is propagated by root divisions, seed and cuttings. Oil yield can be increased by having influence of good quantity of nitrogen-containing soil amendments (Baranauskiene *et al*., 2003) [5]. Thyme is characterized by its volatile oil and used as an herb. Pharmacological actions support some of medicinal uses, which contribute to volatile oil and some flavonoids components (Broucke and Lernli, 1981) [10].

Thyme is famous in all over the world as a food spice and also include in herb form (USDA, 2014) [33] and preservative compound as well as well as for the prevention of many diseases and also used as a protective agent against microorganisms (Bellakhadar, 1991) [9]. Thyme species provides a stable economic return the local communities (Hamilton, 2004) [17]. *Thymus vulgaris* L. is the most essential oil among the tops oil in the world (Horva *et al*., 2004). In foods, it is used as a flavoring agent while in medicines it is used as an antifungal and antiseptic agent (Ramsewak, 2003) [28]. For the treatment of many diseases' thyme is mostly used as an anti-fungal agent (Nabigol and Morshidi, 2011). *Thymus vulgaris* L. and its extracts have been practiced in world for the treatment of many chronic diseases such as inflammatory diseases, cardiovascular diseases, arthritis, diabetes and others (Juhas *et al*., 2008) [19]. It possesses antispasmodic, diaphoretic, antiseptic, disinfectant, carminative, deodorant, sedative, tonic and expectorant properties which are due to Thymol and Carvacrol (Mendivil *et al*., 2006) [25]. 100 g of *Thymus vulgaris* L. leaves provide 1890 mg Ca, 123 mg Fe, 220 mg Mg, 201 mg P, 55 mg Na and 814 mg K Ref No 02042 (USDA, 2014) [33]. Medicinal herbs play a contributor role in maintaining human health all over the world not only in diseased state but also as potential material which is required for maintaining proper health (Verma and Singh, 2008) [34]. It is a widespread medicinal herb which is less toxic and has adverse effect to the patients who use. Pahari Podina (*Thymus vulgaris* L.) is actually a non-toxic herb which is most common in Turkey and Europe (Bardia *et al*., 2007) [6]. Thymus genus contains 18 wild species and one cultivated specie as aromatic plant (*Thymus vulgaris* L.) (Marculescu *et al.,* 2007) [23]. *Thymus vulgaris* L. is a member of family Lamiceae, is an aromatic plant and used for spice and medicinal purposes almost everywhere in world (Verma *et al.,* 2018) [34]. *Thymus vulgaris* L. is a native of Mediterranean countries, also widely grown in France, Spain, Algeria, Portugal, Italy and Morocco (Arraiza *et al.,* 2009) [4]. It is also grown in other countries like North Asia, North America and Europe (Pruthi, 1998) [27].

They contain about 350 species consisting of small plant reaches to 40cm height. Stems become in wire shape and in narrow form. In most species' leaves are evergreen. They are arranged in opposite form, entire, oval, small and

usually aromatic. Their flower has terminal heads having uneven calyx and two-lip flowers which may be in white, yellow or purple color. Their many species may be cultivated as ornamental or culinary herbs. Pollination may be done by flies and bees and flowers are hermaphrodite. Extracts of these plants is in a white crystalline form and may provide aromatic odor and strong antiseptic properties (Ahmad *et al.*, 2010) [1]. *Thymus vulgaris* L. exhibits a polymorphic variation as the intraspecific chemotype variation character is present and is common in the genus Thymus. There are six chemotypes, a-terpineol (A), geraniol (G), linalool (L), thuyanol-4 (U), thymol (T), and carvacrol (C), which isnamed after its character (Pruthi, 1998) [27]. Thyme is a general name.

It has more than 300 species, varieties, hybrids and ecotypes. It is native to Asia and Europe. Thymus world actually derived from Greek language, "thyo" means scent, fumigate or cleanse while "thymon" means courage. For the Greeks, it was the symbol of elegance and grace. They may use this symbol for pleasure. This plant character related to many traditions. The Egyptian peoples consider it important in embalmment. The soldiers of Roman used it for vigor gain during taking bath. In the age of Chivarley, before any jousting tournament motifs of thyme were used as embroidery in knight's scarves which gives courage. Thyme springs were burned indoors to cleanse air and gives protection against plague. In the past, this plant was thought to be planted on graves in Wales. Furthermore, it was famous as a superstition believes that in the garden, planting a bed of thyme attracts the fairy which brings it to the home. During World War 1, Thyme oil was used as antiseptic agent. Nowadays it is still used to protect paper from mold, used in embalmment liquids and also used to preserve botany and anatomy of species (Verma *et al.*, 2018) [34].

2. Properties of Pahari Podina (*Thymus vulgaris* L.)

2.1 Thyme as an antifungal agent

Fungal infections are most common problems in agriculture and many seed germination studies during germination of crop seeds. In the department of plant protection, an experiment was done to evaluate the effects of fungicides of thymus vulgaris on soybean, wheat, maize and cumin during the germination stage. An aqueous extract of thyme shoot was prepared. This herb extract was added to petri dishes containing seeds at six concentrations with daily watering. During germination of seeds, fungi activity was decreased with the increase of herbal extract. It shows that thyme can act as antifungal agent (Valizadegan, 2013). For the treatment of diseases which are due to pathogens, thyme is mostly used for this. Its most important property is to treat many fungus infections of the skin as an antifungal agent (Nabigol and Morshidi, 2011). Thyme plant which is used as a fungicide thought to be used in agriculture due to the anti-fungal potential. It can be mostly concern with the favorable environmental responses (Imelovane *et al.*, 2009). Herbal extract of thyme as a fungicide which may be consumed by some beneficial insects gives some ecological advantages. Toxicity becomes less, safety will increase and ability to decompose becomes rapid after use (Branauskiene *et al.*, 2003). Nowadays use of safe and natural pesticides is very important with approach to organic and sustainable agriculture. Many aromatic and medicinal plants are used in this regard. These types of plants have low cost of production economically. Natural pesticides are cheaper than chemical type pesticides (Hudaib *et al*., 2002). Gas chromatography/ Mass spectroscopy analyzed the essential oil which may be extracted from Thyme (*Thymus vulgaris* L.) and its fungicidal activity may be evaluated. Its main components are thymol (16.6%), borneol (28.4%), camphene (6.9%), cavacrol methyl ether (9.6%), alpha-humelene (6.4%) and cavacrol (5.0%). Tests of fungal activity was done which tells that when added a potato dextrose agar culture medium, then 1000 ppm concentration of thyme essential oil was beneficial to inhibit Alternariacitri (Mendivil *et al*., 2006) [25].

2.2 Thyme as an anti-oxidant agent

Raw material causes lipid oxidation during storage, processing, heating till finishing the product. Rancidity is the problem which occurs during storage in many food products (Donelli and Robinson, 1995) [14]. Many organoleptic properties maybe affected by oxidative deterioration which makes the product unacceptable for consumption like taste and aroma. Many investigations were done with the purpose of increasing the shelf life, maintenance of food quality and lipid containing products (Karpinska *et al.*, 2001) [21]. Thyme has an anti-oxidant effect as flavonoids essentially based on polyphenolic compounds while having high activity of thymol and cavacrol (Justesen and Knuthsen, 2001) [20]. *Thymus vulgaris* L. contains flavonoids having a group of pigments which are responsible for fruit and flower coloration. Flavonoids also found in many dietary fruits and vegetables which exhibit many biological properties including anti-oxidant activities (Tripoli, 2007) [32]. Antioxidant substance of thyme is tymol. It has been concluded that the essential oil and phenolic compounds which can extracted from thyme act like antioxidant in the lipid system of body (Sengul, 2008). Three varieties of *Thymus vulgaris* L. which has methanol extracts "slava", "german winter" and "pagane" which shows thymol, citrol and geraniolchemotype and then evaluated for phenolic and antioxidant potential. By spectrophotometric method using foling-ciocalteu reagent, phenolic contents were determined. The antioxidant activity of extracts was determined by 1, 1-diphenyl-2-picrylhydrazal radical free radical assay. All extracts exhibit free radical activities. Thymolchemotype "german winter" has high anti-oxidant activity. The other two species have low anti-oxidant and phenolic components (Nikolova *et al.*, 2012). Flesh of tuna (Thunnus thynnus) was treated with dried form of thymus vulgaris; vacuum packaging was done and then stored it for 18 days at 0^0C. During period of storage, proximate composition, total volatile bases, thiobarbiturtic acid reactive substances (TBARS), pH, trimethyl amine and fatty acid composition were determined and found no difference between ash, moisture, lipid and protein. Unaffected fatty acid composition was found in thyme-treated lot while the antioxidant effect was determined by low level of TBARS (Selmi and Sadok, 2008). Despite the antibacterial and antioxidant property of herbal and vegetable extract of *Thymus vulgaris* L., it is also used to enhance shelf life of chilled fish and fish products (Chaieb *et al.*, 2007).

2.3 Thyme as an anti-microbial agent

Thymus vulgaris L. (thyme) also known as zaatar or zaitra extensively used in traditional medicine for its antibroncholitic, expectorant, antispasmodic and diuretics

activities. Thyme has become one of the famous plants all over the world because of its aromatic and medicinal properties. It was commonly used as flavoring agents, herbal tea and also used as medicinal plant (Biskup and Saeez, 2002). The essential oil of *Thymus vulgaris* L. contains the antimicrobial properties. The compounds which are isolated from this plant and herbs eliminate the pathogenic causing microorganism and exhibit the biological activity which has built up to antibiotics. Essential oil of thyme has been used for respiratory tract infections and nowadays used as traditional medicine for cold. In the medical field, to treat acute sinusitis and bronchitis, inhalation therapy of essential oil has been used. When vapors of essential oils inhaled, it augmented the respiratory tract fluid, maintained the drainage and ventilation of the sinuses occurs, reduced the asthma and had anti-inflammatory effect on trachea (Sebesan and Caraban, 2008). Cavacrol, an isomer of thymol also exhibits antimicrobial properties which is isolated from oregano and thyme (Helander *et al*., 1998). It has been declared that essential oil of some plants possesses antimicrobial properties (Finnemore, 1926). Against the non-toxic strain of *E. coli*, thyme essential oil shows the bactericidal and bacteriostatic properties in a wide temperature range. It was investigated that lecithin decreases the antibacterial properties (Burt and Reinders, 2003) [11].

3. Experimental study of Pahari Podina *(Thymus vulgaris L.)*

A study was conducted to check the dietary supplementation of *Thymus vulgaris* L. on the laying hens and concentration of E. coli in feces. Sixty-four hens were arranged in four groups of 24 weeks old. Each procedure was repeated four times. Supplementation diet was prepared with the addition of thyme at varying concentration to basic diet. Conservation of feed and the ability of producing eggs were improved by the thyme supplementation diet and also it reduces the concentration of *E. coli* in feces (Canan *et al*., 2007). Leishmaniasis is a parasitic disease which is transmitted by flies. An investigation was arranged to check the effective treatment against Leishmaniasis. In this study, herbal extract of thymus vulgaris were used for the treatment of mice suffering from Leishmaniasis. Five groups of 45 mice were randomly selected. Firstly, they treated with pure ethanol and then herbal extract of thymus vulgaris for six weeks. After carrying out analysis, it was proved that thymus vulgaris was more effective for the Leishmaniasis treatment (Nilforoushzadeh *et al*., 2008). Antioxidant substance of thyme is thymol. It has been concluded that the essential oil and phenolic compounds which can extracted from thyme act like antioxidant in the lipid system (Sengul *et al*, 2008).

4. Pahari Podina *(Thymus vulgaris* L.*)* against diseases

A complete extracted mixture of *Thymus vulgaris* L. from leaves has various pharmacological properties not only as preventive compound but also for the treatment of many diseases (Burt, 2004) [11]. It is a well-known herb in many traditional medicines and used for treatment of many chronic diseases (Rehman *et al*., 2009). *Thymus vulgaris* L. exhibits anti-platelet properties in human, controls blood sugar level and inhibits irregular cell growth, aid in maintaining blood pressure and healthy cholesterol level (Elkayam *et al.,* 2003) [15]. Because of their pharmacology and biological properties, it is known as a popular medicinal plant (Al Maqtari *et al.*, 2011) [3]. *Thymus vulgaris* L. as anti-oxidant, anti-hypertensive and anti-thrombin helps in renal function, clearance of creatinine and prevent the excess thickening and hardening (Kulisic *et al*., 2004) [22]. Thyme shows many biological properties involving anti-bacterial, anti-fungal, antioxidant, anti-inflammatory and also useful for many healing treatments and many health care's practices (Zargari, 1990) [36]. Consumption of thymus extracts are beneficial from ancient times and is recommended throughout the world (Akerele, 1993) [2]. Thyme plant as compared to antibiotics has considered useful for growth promoter in poultry products (McDevitt *et al.*, 2007) [24]. In spite of modern pharmaceutical antibiotics, thyme oil was used in bandages for medication purposes (Baydar *et al*., 2004) [7]. Nowadays thymol has been considered as active ingredient for the treatment of toenails that is due to infection of various fungi and bacteria (Cosentino *et al.,* 2013) [13].

5. Conclusions and Future prospects

Thymus vulgaris is a species of flowering plant in the mint family *Lamiaceae*, native to southern Europe from the western Mediterranean to southern Italy. It is a bushy, woody-based evergreen subshrub with small, highly aromatic, grey-green leaves and clusters of purple or pink flowers in early summer. It is useful in the garden as groundcover, where it can be short-lived, but is easily propagated from cuttings. It is also the main source of thyme as an ingredient in cooking and as an herbal medicine. It is slightly spicier than oregano and sweeter than sage. It also has medicinal uses. Oil of thyme, the essential oil of common thyme contains 20-54% thymol. Thyme essential oil also contains a range of additional compounds, such as p-cymene, myrcene, borneol, and linalool. Thymol, an antiseptic, is an active ingredient in various commercially produced mouthwashes such as Listerine. Before the advent of modern antibiotics, oil of thyme was used to medicate bandages. It is an important nectar source plant for honeybees. This literature helps for further studies in future.

6. References

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