Pyrethrum, Coltsfoot and Dandelion: Important Medicinal Plants from Asteraceae Family

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Abstract: Medicinal plants synthesize substances that are useful to the maintenance of health in humans and animals. Asteraceae (Compositae) is one of the largest families contains very useful pharmaceutical genera such as chrysanthemum, Tussilago and Taraxacum. Pyrethrum is under cultivation around the world and is known for its insecticidal activity. Coltsfoot is a perennial plant. The extracts of coltsfoot exhibit antioxidant and antimicrobial activity. Dandelion is almost stemless and a perennial herb. This plant is a good indicator of environmental pollution. Dandelion has shown anti-inflammatory activity and the aqueous extract seems to have anti-tumour activity. The objective of this study was review of researches regarding to these plants and their secondary metabolites.

Key words: Chrysanthemum cinerariaefolium, Tussilago farfara, Taraxacum officinale, secondary metabolites, compositae.

INTRODUCTION

Medicinal and aromatic plants use by 80% of global population for their medicinal therapeutic effects as reported by WHO (2008). Many of these plants synthesize substances that are useful to the maintenance of health in humans and other animals. These include aromatic substances, most of which are phenols or their oxygen-substituted derivatives such as tannins. Others contain alkaloids, glycosides, saponins, and many secondary metabolites (Naguib, 2011).

Asteraceae (Compositae) is one of the largest families of vascular plants represented by 22750 species and over 1528 genera all over the world (Bremer, 1994). This family contains very useful pharmaceutical genera such as chrysanthemum, Tussilago and Taraxacum (Hadaruga, et al., 2009). The objective of this study was review of researches regarding the pyrethrum, coltsfoot and dandelion and their secondary metabolites.

Pyrethrum:

Pyrethrum, Chrysanthemum cinerariaefolium, is under cultivation around the world with Kenya production for about 83% of the present world production (Bhat, et al., 1985).

Its flowers yield an important insecticide, i.e. the pyrethrins. The pyrethrin content has been an important character for breeders (Pandita, et al., 1989).

Pyrethrum is a perennial temperate plant and has white flowers with yellow center. This plant needs a rainfall of 1000-1200 mm and a well drained fertile soil. Vernalization is essential for flower initiation in this plant (Dessalgne, et al., 2011).

An important group of compounds isolated from pyrethrum flowers known as Pyrethroids. These compounds include Cinerin I (5.1%), Cinerin II (5.3%), Jasmolin I (2.5%), Jasmolin II (2.4%), Pyrethrin I (19.9%) and Pyrethrin II (15.3%) (Essig and Zhao, 2001).

They are extracted as an oil or dry powder shortly after the flower blooms. Approximately 94% of the total yield of the Pyrethrin is concentrated in the seeds of the flower (Casida and Quistad, 1995).

There are several sesquiterpene lactones in pyrethrum such as Chrysanolide, β-Cyclopyrethrosin, Chrysanin, Dihydro-β-cyclopyrethrosin and Taraxasterol (Doskotch, et al., 1971).


Researchers identified flavonoid compounds such as Apigenin-4-glucuronide, Apigenin-7 galacturonic acid methyl ester, Apigenin-7-glucuronic acid, Jacein and Luteolin (Rao, et al., 1973; Sashida, et al., 1983).

Arachidic, Behenic, Henecisoanoic, Heptadecanoic, Heptacosanoic, Hexacosanoic Linoleic, Linolenic, Lignoceric, Myristic, Nonadecanoic, Oleic, Octacosanoic, Palmitic, Pentadecanoic, Pentacosanoic, Stearic, Tricosanoic and Triactonanoic are fatty acids identified in pyrethrum (Head, 1968).

Pyrethrum is known for its insecticidal activity (Casida, 1980; Moorman and Nguyen, 1997). About 200,000 kg of pyrethrins are used as an insecticide each year (Crosby, 1995). Carpenter, et al., (1950) showed the toxicity of pyrethrins and allethrin to rats, rabbits and dogs. They reported the oral LD50 of Pyrethrum oleoresin at 820 mg/kg on male and female Sherman strain white rats, whereas the LD50 of the purified 20% pyrethrins extract was 1870 mg/kg. This shows greater toxicity of the unpurified oleoresin.

Pyrethrins are generally effective insecticides that display low toxicity to mammals and breakdown quickly under environmental conditions such as sunlight (Chen and Casida, 1969).

Some by-products such as pyrethrum marc (pymace), a product of pyrethrum is known to have a relatively high nutrient concentration. Researchers show that wastes products such as pymace may offer an alternative and effective material for supply of plant nutrients on a long term basis on mineralisation, which can increase nutrients, particularly P in P deficient soils (Nyongesa, et al., 2009).

**Coltsfoot:**

*Coltsfoot, Tussilago farfara,* is a perennial weed in the temperate zone and can spread into cultivated fields from rhizomes which is the major cause of its weediness (Wild, et al., 2003). This is widely spread in Korea, China, North Africa, Siberia, and Europe. Its flower buds are known as an important folk medicine used in the treatment of cough and wheezing (Bensky, et al., 2004).

Pyrrolizidine alkaloids, a class of hepatotoxic and tumorigenic compounds, have been detected in herbal plants. A number of pyrrolizidine alkaloid-containing plants have been used as vegetables in Japan, including *Tussilago farfara, Petasites japonicus, Farfugium japonicum,* and *Symphytum officinale* (Hirono, et al., 1983; Fu, et al., 2002). The tumorigenic substances in *T. farfara* are senecionine and senkirkine (Roeder, 2000). The root and leaves of coltsfoot has medicinal benefits in chronic bronchitis, asthma, influenza, chest complaints and inflammations. The leaves are smoked like tobacco, as a domestic remedy for asthma (Ergen Akcin, 2007; Qureshi, et al., 2007). Coltsfoot also contains triterpenes like friedelane, baueren, lanostane, lupane, ursane and oleane (Ehrman, et al., 2007).

The extracts of coltsfoot exhibit antioxidant effect, antimicrobial activity, and inhibitory effects on NO synthesis in LPS-activated macrophages and diacylglycerol acyltransferase activity (Ryu, et al., 1999; Kokoska, et al., 2002; Cho, et al., 2005).

Its extracts contain valuable antioxidant active components, which might be helpful in preventing or slowing the progress of various oxidative stresses (Dobravalskye, et al., 2011).

Hadaruga, et al., (2009) revealed biocompounds in leaf of this plant as alpha-Bisabolol oxid B (2.76%), alpha-Bisabolol (20.65%), Camazulene (7.18%), Bisabolol-oxid A (0.91%) and in root as alpha-Bisabolol (14.23%) and Camazulene (3.17%).

Five oplopane-type sesquiterpenoids, 7β-senecioyoxyoplop-3(14)Z,8(10)-dien-2-one (1), 7β-angeloyloxyoplop-3(14)Z,8(10)-dien-2-one (2), 7β-(4-methylsenecioyoxy)oplop-3(14)Z,8(10)-dien-2-one (3), 1α-angeloyloxy-7β-(4-methylsenecioyoxy)oplop-3(14)Z,8(10)-dien-2-one (4) and 1α,7β-di(4-methylsenecioyoxy)oplop-3(14)Z,8(10)-dien-2-one (5), were isolated from the flower buds of coltsfoot (Yaota, et al., 1999).

An investigation showed bisabolane-type sesquiterpenoids, (3R,4R,6S)-3,4-epoxybisabol-7(14),10-dien-2-one and (1R,3R,4R,5S,6S)-1-acetoxy-8-angeloyloxy-3,4-epoxy-5-hydroxybisabol-7(14),10-dien-2-one, and a new oplopane-type sesquiterpenoid, 14(R)-hydroxy-7β-isovaleroyloxyoplop-8(10)-en-2-one, in coltsfoot flower bud (Yaota, et al., 2001).

Tussilagone, isolated from the flower of *T. farfara,* is a sesquiterpenoid that is known to exert a variety of pharmacological activities such as anti-inflammatory activities in murine macrophages by inducing heme oxygenase-1 (HO-1) expression (Hwangbo, et al., 2009).

Wu, et al., 2008. reported some active substances of *T. farfara* from previous works: some triterpenoids such as arnidiol, faradiol, bauerenol, isobauerenol and some common flavonoids, quercetin, kaempferol and their glycosides. They found Chromones from the flower buds of *T. farfara.*

**Dandelion:**

*Dandelion, Taraxacum officinale,* is almost stemless and perennial herb. The stems are 1–2.5 cm in length. The leaves form a basal, radial rosette. The capitulum is composed of up to 250 ligulate, perfect, yellow florets (Holm, et al., 1997). Dandelion has been used for medicinal purposes including to improve liver function, lower cholesterol, lower blood pressure (Mattern, 1994), decrease body weight in obese patients, treat gall bladder ailments (Dalby, 1999) and as a diuretic (Racz-Kotilla, et al., 1974).

Dandelion contains triterpenoid and sterol bitter principles (principally taraxacin and taraxacerin), in the roots, leaves, and flowers. Other compounds include betaamyrin, taraxasterol, and taraxerol and free sterols (sitosterin, stigmasterin, and phytosterin). It contains large amounts of polysaccharides (primarily fructosans and inulin), Dandelion is a perennial weed in the temperate zone and can spread into cultivated fields from rhizomes which is the major cause of its weediness (Wild, et al., 2003). This is widely spread in Korea, China, North Africa, Siberia, and Europe. Its flower buds are known as an important folk medicine used in the treatment of cough and wheezing (Bensky, et al., 2004).

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smaller amounts of pectin, resin, and mucilage, and various flavonoids (Rutherford, 1972; Cordatos, 1992). Leaves also contain appreciable amounts of furan fatty acids (Hannemann, et al., 1989). Dandelion has feed value, with low amounts of essential oils and tannin that might affect quality or palatability (Falkowski, et al., 1990). It is a rich source of vitamins and minerals, including beta carotene, nonprovitamin A carotenoids, xanthophylls, chlorophyll, vitamins C and D, many of the B-complex vitamins, choline, iron, silicon, magnesium, sodium, potassium, zinc, manganese, copper, and phosphorous. (Cordatos, 1992; Popescu, et al., 2010).

This plant is a good indicator of environmental pollution and is often used as a biomonitor because the leaves and roots accumulate metals, including As, Br, Cd, Co, Cu, Cr, Hg, Mn, Pb, Sb, Se and Zn (Kuleff and Djingova, 1984; Djingova, et al., 1986; Simon, et al., 1996).

Pollens of dandelion can be a potential source of photoallergic contact dermatitis (Lovell and Rowan, 1991; Mark, et al., 1999). Dandelion has shown anti-inflammatory activity in animal studies (Mascolo, 1987; Jeon, et al., 2008) and the aqueous extract seems to have anti-tumour activity (Nevall, et al., 1996). This plant use in therapy for hepatitis and the drug also has diuretic and choleretic actions (Bradley, 1992; Bisset, 1994). It is used to treat a variety of diseases including cancer (Sigstedt, et al., 2008).

The drug Taraxaci radix cum herba contains: sesquiterpenlactones, triterpenes, phytosterols, carbohydrates, phenolic acids and flavonoids (Bradley, 1992; Bissett, 1994; Newall, et al., 1996; Williams, et al., 1996).

Results of the comparative quantitative chemical analysis in different parts of plant revealed that total hydroxycinnamic acid derivatives and flavonoids had the highest values in leaves and flowers (Popescu, et al., 2010).

Sengul, et al., (2009) indicated antioxidant activity (43.05%) and total phenolic content (15.50 mgGAE/g DW) in this plant.

REFERENCES


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