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Review Article

A REVIEW ON MEDICINAL IMPORTANCE OF BABCHI (PSORALEA CORYLIFOLIA)

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ABSTRACT

Psoralea corylifolia is an important medicinal plant which is used in several traditional medicines to cure various diseases. *Psoralea corylifolia* (**Babchi**) is useful part of Indian Ayurveda, Tamil Siddha and Chinese systems of medicine. The plant possesses antibacterial, anti-depressent, antitumor, antioxidant, anti-inflammatory, antifungal and immunomodulatory activity. This paper is a comprehensive overview of the literature summarized on chemical constituents and pharmacological activities of P. corylifolia, which will be beneficial for further research and development.

INTRODUCTION

Psoralea corylifolia (**Babchi**) is an important plant in the Indian Ayurveda and Tamil Siddha systems of medicine, and also in Chinese medicine (http://www.home-remedies-for-you.com/askquestion/3682/what-are-the-benefits-and-side-effects-of-babchi-oil.html).

Psoralea corylifolia Linn. (P. *corylifolia*) is a widely used medicinal plant in Asia and India (Yadava and Verma, 2005; Miura, Nishida and Iinuma, 1996). A number of chemical constituents, including flavonoids and coumarins, have been isolated from this plant. Some of these compounds exhibit antioxidant (Guo *et al*., 2005), antiplatelet (Tsai, Hsin and Chen, 1996), estrogenic (Lim *et al*., 2011), immunomodulatory, and antitumor properties (Latha *et al*., 2000; Qu *et al*., 2011), anti inflammatory activities (Haraguchi *et al*., 2002; Karsura *et al*., 2001; Ferra´ndiz *et al*., 1996). Various studies have reported antibacterial effects. (Yin *et al*., 2004; Khatune *et al*., 2004). PCS (*Psoralea corylifolia seed*) extract is used in a variety of diseases such as leucoderma (Prasad *et al*., 2004) and for impotence (Yang, Chang and Park, 2008). The Chinese believe that *P. corylifolia* is an excellent tonic remedy, for improving overall health and vitality. http://www.home-remedies-for-you.com/askquestion/3682/what-are-the-benefits-and-side-effects-of-babchi-oil.html. The *P. corylifolia* seeds (PCS), commonly known as "Boh-Gol-Zhee" in Korea, have been used traditionally as a medicinal remedy (Eunhui *et al*., 2013). They are also known as sabza, subza, takmaria, tukmaria, selasih. (https://lentilsandlunges.wordpress.com/2014/05/13/chia-or-sabja-there-is-adifference/Chia or Sabja? There IS a Difference!). *P. corylifolia* is also known as Babchi. The active component in the seeds is an essential oil. (http://www.home-remedies-for-you.com/askquestion/3682/what -are-the-benefits-and-side-effects-of-babchi-oil.html). *P. corylifolia* has been widely used for the treatment of various diseases such as leucoderma and other skin diseases, cardiovascular diseases, nephritis, osteoporosis, and cancer (Zhang *et al*., 2016).

Classification: The plant classification details are: (Mukherjee, 2002)
Kingdom: Plantae
Division: Angiospermae
Class: Dicotyledoneae
Order: Rosales
Family: Leguminosae
Subfamily: Papilionaceae
Genus: *Psoralea*
Species: *corylifolia* Linn.

Distribution: The plant grows in tropical and subtropical regions of the world including Southern Africa, China, and India; it is also found throughout India in Himalayas, Dehra Dun, Oudh, Bundelkhand, Bengal, Bombay, some valley in Bihar, Deccan, and Karnataka. (https://examine.com/supplements/psoralea-corylifolia/). This plant is also widely distributed in the tropical and subtropical regions of the world, especially China and Southern Africa

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(Krishnamurthi *et al*., 1969; http://www.mdidea.com ; http://www.herbsguide.net)

***Description of the Plant*:** It is a small, erect, annual herb growing up to 60–120 cm in height throughout sandy, loamy plains of Central and East India (Joshi, 2000; Sebastian, 2006). Chopra *et al* found that the seeds contain an essential oil (0.05%), a nonvolatile terpenoid oil, a dark brown resin (8.6%), and traces of alkaloidal substance. Dymock stated that the seeds contain 13.2% of extractive matter, albumin, sugar, ash 7.4%, and traces of manganese. (Chopra and Chopra, 1958; Panda, 2000)

Composition: *P. corylifolia* extract contains a number of chemical compounds including flavonoids (neobavaisoflavone, isobavachalcone, bavachalcone,bavachinin, bavachin, corylin, corylifol, corylifolin and 6-prenylnaringenin), coumarins (psoralidin, psoralen, isopsoralen and angelicin) and meroterpenes (bakuchiol and 3-hydroxybakuchiol) *(Zhao et al., 2005)*. Very high concentrations genistein have been found in the leaves of *P. corylifolia (Kaufman et al., 1997)*. Many studies have confirmed that plants and foods rich in polyphenolic content are effective scavengers of free radicals, thus helping in the prevention of these diseases through their antioxidant activity (Fazelian and Eslami, 2009). Antioxidants which are present in plants, herbs and dietary sources help in preventing vascular diseases in diabetic patients (Buyukbalci and Sedef Nehir, 2008). Tannins and flavonoids are the secondary metabolites in plants considered to be the natural source of antioxidants which prevent destruction of β-cells and diabetes-induced ROS formation. (Aslan *et al.*, 2010) Thus, it is a good strategy to manage diabetes as a whole with plants which show good enzyme inhibitory and antioxidant activities (Joshi *et al*., 1999).

Different Plant Parts and Their Uses*:* The plant can be used externally or it can be taken internally. Seeds, seed oil, roots, and leaves are being used (Khare, 2004, http://www.motherherbs.com, http://www.india-shopping.net). Most parts of the plant (roots, leaves, seeds and an oil from the seeds) appear to be used, seeds being most commonly used (Khushboo *et al*., 2010).

Seeds

Seeds are sweet, bitter, acrid, and astringent. They impart vigor and vitality; improve digestive power and receptive power of mind (Joshi, 2000).

People take babchi seeds orally, for curing various health conditions, such as an intestinal worm infestation. However, an overdose of babchi seeds could bring about some adverse side effects, such as headaches, nausea, diarrhea and vomiting (http://www.home-remedies-for-you.com/askquestion/3682/ what-are-the-benefits-and-side-effects-of-babchi-oil.html).

Seed and extract powder are used as diuretic, anthelminthic, laxative, and for healing wounds (Mukherjee, 2002; Rajpal, 2005). Seeds are antipyretic and alexiteric (Agharkar, 1991). Seeds are used as stomachic, stimulant, aphrodisiac, (Mukherjee, 2002) and diaphoretic (Sharma, Yelne and Dennis, 2001). It is an effective invigorant against impotence, menstruation disorder, and uterine hemorrhage. It shows coronary vasodilatory activity (Ruan *et al*., 2007). It is a cure for gynecologic bleeding (Qiao *et al*., 2006). It is also useful to treat spermatorrhea and premature ejaculation (Lin *et al*., 2007). The seeds act as deobstruent and heal ulcer, heart troubles, and cure blood disorders and elephantitis (Khatune *et al*., 2002). Seeds are given in scorpion-sting and snake bite (Panda, 2000; Nadkarni, 1976). Seeds are useful in bilious disorders (Panda, 2000; Kapoor, 2001).

The crude drug has been used for the treatment of enuresis, pollakiuria, painful feeling of cold in the waist and knees, and weak kidney (Zhao *et al*., 2005; Zhao, Wu and Xiang, 2005). It is used in the treatment of debility and other problems related to kidney inefficiency, such as febrile disorders, low back pains, frequent urination, incontinence, and bed wetting (http://www.mdidea.com).

Roots

The root is useful in treating the caries of the teeth. *P. corylifolia* is used to promote bone calcification, making it useful for treating osteoporosis and bone fractures (Krishnamurthi *et al*., 1969; http://www.mdidea.com ; Joshi, 2000). The root of the *P. corylifolia* plant can be used in the treatment of dental problems (http://www.home-remedies-for-you.com/askquestion/3682/what-are-the-benefits-and-side-effects-of-babchi-oil.html).

Leaves

Leaves are used to alleviate diarrhea (Krishnamurthi *et al*., 1969).

Fruits

Fruit is bitter, helps to prevent vomiting, cures difficulty in micturition, used in treating piles, bronchitis, and anemias and improves complexion (Joshi, 2000). The fruit of the *P. corylifolia* plant are believed to have aphrodisiac properties and can be applied to the genital organs, as a tonic. The fruits are generally used for treating febrile diseases, incontinence, premature ejaculation, bed wetting, frequent urination, impotence and lower backaches. The antibacterial properties that are present in the fruit are known to restrict the growth of mycobacterium tuberculosis (http://www.home-remedies-for-you.com/askquestion/3682/what-are-the-benefits-and-side-effects-of-babchi-oil.html).

Oil

The use of *P. corylifolia* oil can help cure several skin diseases like tinea versicular, scabies, ringworm and psoriasis. People also use babchi oil for vitiligo treatment (http://www.home-remedies-for-you.com/askquestion/3682/what-are-the-benefits-and-side-effects-of-babchi-oil.html).

Pharmacology

An extract of the plant's fruit *Fructus psoraleæ* has been shown to act as a norepinephrine-dopamine reuptake inhibitor *in vitro (Zhao et al., 2007)*.

Extracts obtained from the seeds of *P. corylifolia* have been shown to inhibit mitochondrial complex I *in vitro* and may therefore increase susceptibility to oxidative stress *(Tang et al., 2007)*. *P. corylifolia* has been implicated in at least one case of severe hepatotoxicity in a 64-year-old woman who self-medicated with a variety of Aryuvedic herbs for her vitiligo.

The authors identify psoralens as "the primary candidate causing the hepatotoxic reaction *(Teschke and Bahre, 2009)*.

Uses According To Their Pharmacological Importance

Phytochemical studies indicated that coumarins, flavonoids, and meroterpenes are the main components of *P. corylifolia,* and most of these components are present in the seeds or fruits. The extracts and active components of *P. corylifolia* demonstrated multiple biological activities, including estrogenic, antitumor, anti-oxidant, antimicrobial, antidepressant, anti-inflammatory, osteoblastic, and hepatoprotective activities (Zhang *et al*., 2016).

Antioxidant Activity

The structures of the isolated compounds were identified by (1) H NMR and (13) C NMR. The results of antioxidant activity estimation by electron spin resonance (ESR) method showed that psoralidin was the most active antioxidant with an IC50 value of 44.7microM. This is the first report on simultaneous separation of eight compounds from *P. corylifolia* by HSCCC (Xiao *et al*., 2010). Guo *et al.* (2005) proved that the powder and extracts of *P. corylifolia* possessed strong antioxidant properties when tested in lard at 100°C by using oxidative stability instrument. Antioxidant activity of compounds decrease in the following order: Psoralidin > BHT > α-tocopherol > bakuchiol > corylifolin > corylin > isopsoralen > psoralen (Guo *et al*., 2005). Bakuchiol and 2 of the flavonoids, isobavachin and isobavachalcone, showed broad antioxidant activities in rat liver microsomes and mitochondria (Rajpal, 2005).

Antibacterial Activity

Staphylococcus aureus causes a variety of human diseases, ranging from minor skin infections to severe sepsis, and MRSA (Methicillin-Resistant *Staphylococcus aureus*) has become one of the most frequently encountered antibiotic-resistant bacteria. Since a number of prenylflavonoids and related compounds were isolated from *P. corylifolia* (Yin *et al*., 2004; Cheng *et al*., 2007; Wang *et al.,* 2004).

(Yanmei *et al*. (2015) preliminary research showed that *P. corylifolia* fruit extract exhibited remarkable antibacterial effects on MRSA, several anti-MRSA constituents were found in *P. corylifolia* fruits, indicating that this plant may be a valuable resource for lead compound development of anti-MRSA drugs. They isolated 17 compounds from the ethyl acetate extract of *P. corylifolia*. Among these compounds, two new compounds, bakuisoflavone and bakuflavanone, were elucidated to be 4′,7-dihydroxy-3′-(2-hydroxy-3-methyl-3-butenyl)-isoflavone and 4′,7-dihydroxy-3′-(2-hydroxy-3-methyl- 3-butenyl)-flavanone, respectively. The antibacterial effects of the isolated compounds, which were categorized as a flavone , flavanones, isoflavones, chalcones, meroterpenes, and coumarins, were examined. Among them, isobavachalcone and bakuchiol showed significant anti-MRSA effects. Corylifol C, neobavaisoflavone and corylifol B also showed potent antibacterial effects. According to quantitative analysis, these effective compounds are all highly present in *P. corylifolia*. Their findings suggest that this plant may be a promising resource for lead compound development of anti-MRSA drugs (Yanmei *et al*., 2015).

Chanda, Kaneria and Nair (2011) screened thirteen plants for their in vitro antibacterial potentiality. The antibacterial activity of aqueous and methanolic extracts of the plants was evaluated against 5 microorganisms by agar well diffusion method. Amongst the 13 plants screened, *P. corylifolia* showed best antibacterial activity and hence this plant was selected for further studies. The seed and aerial parts of *P. corylifolia* was extracted successively using a series of various organic solvents. All the extracts of seed and aerial parts were active against S. epidermidis and P. morganii while none of the extracts were active against A. fecalis. Maximum antibacterial activity was shown by dioxan extract of the seed. Their findings suggest that the dioxan extract of seed of *P. corylifolia* can be used as a promising novel antibacterial agent in the near future (Chanda, Kaneria and Nair, 2011).

A potential antifilarial activity of *P. corylifolia* leaves and seeds on cattle filarial parasite *Setaria cervi* was observed (Rajpal, 2005).The alcoholic extract produced death of microfilariae and showed antimycobacterial activity (Gupta, Neeraj and Madhu, 2005). Khatune *et al*. (2002) proved pesticidal activity of 6-(-3-methylbut-2-enyl)-6',7-dihydroxycoumestan.

Estrogenic Actvity and Bone Density

P. corylifolia is a herb with a variety of unique compounds, traditionally touted for its usage in menopause to fight signs and symptoms of estrogen deficiency. There is limited evidence in humans currently, so most conclusions are based upon animal models and *in vitro* research (https://examine.com/supplements/psoralea-corylifolia/).

Estrogenic activities of ethanol extract and its active components from *P. corylifolia* L. were studied using various *in vitro* assays. The main components from ethanol extract were analyzed to be bakuchiol, psoralen, isobavachalcone, isobavachromene, and bavachinin. In a fractionation procedure, hexane and chloroform fractions showed estrogenic activity in yeast transactivation assay and E-screen assay. In yeast transactivation assay, ethanol extract, hexane, and chloroform fractions showed significantly higher activities at a concentration of 1.0 ng/ml, and bakuchiol at the concentration of 10^{-6} M was showed the highest activity, especially, which was higher than genistein at the same concentration. In E-screen assay, cell proliferation of bakuchiol (10^{-6} M) showed similar estrogenic activity with genistein (10^{-6} M). In ER binding assay, bakuchiol displayed the strongest ER-binding affinity (IC_{50} for ERα = 1.01×10^{-6} M, IC_{50} for ERβ = 1.20×10^{-6} M) and bakuchiol showed five times higher affinity for ERα than for ERβ (Lim *et al*., 2011).

The estrogenic activity of 70% EtOH extracts of 32 traditional Chinese medicinal plants was assessed and *one of the efficient plant was P. corylifolia.* Their study gave support to the reported efficacy of Chinese medicines used for hormone replacement therapy (Zhang *et al*., 2005). The active fractions yielded seven compounds including the two coumarins isopsoralen and psoralen, the four flavonoids isobavachalcone, bavachin, corylifol A and neobavaisoflavone, and the meroterpene phenol, bakuchiol all the compounds have estrogenic activity, they may exert different biological effects. In conclusion, both ER subtype-selective and nonselective

activities in compounds derived from PCL suggested that PCL could be a new source for selective estrogen-receptor modulators (Xin *et al*., 2010).

One component of Psoralea, Bakuchiol, shows greater efficacy at a concentration of 1uM was able to activate the estrogen receptor with a potency similar to Genistein (one of the Soy Isoflavones) and had a binding affinity to the estrogen receptors of 1.01uM and 1.6uM for alpha and beta subunits respectively, with a five-fold affinity for ERα (Lim *et al.,* 2011) this affinity has been noted to merely be three-fold elsewhere, where the IC_{50} value was found to be 1.34mcg/mL (Lim *et al.,* 2009).

Psoralen and Isopsoralen show selectivity to the alpha subunit, while four other flavonoid compounds did not show selectivity but failed to proliferate MCF-7 cells (suggesting weak estrogenicity) (Xin *et al.,* 2010). Most likely, Bakuchiol is the biologically relevant phytoestrogen. A few molecules in Psoralea may be phytoestrogens, and although isolated Bakuchiol appears to be relatively potent the overall plant extract of *P. corylifolia* does not appear to be remarkably potent (https://examine.com/supplements/psoralea-corylifolia/). It does appear to have some promise for the purpose of bone regeneration in several rat models of menopause, and this appears to be traceable to several different molecules; the class of prenylated isoflavones appears to enhance bone cell differentiation and said rat studies have confirmed an increase in bone mass. (https://examine.com/supplements/psoralea-corylifolia/).

Recent research suggests that *P. corylifolia* has potent oestrogenic effects and that its seeds may be a useful remedy for bone fractures, osteomalacia and osteoporosis (Zhang *et al*., 2005). Components derived from *P. corylifolia*, including bakuchiol, corylifolia, corylin, psoralidin and isobavachin, have strong antioxidant activities (Haraguchi *et al*., 2002), and corylin and bavachin have been shown to stimulate osteoblastic proliferation (Wang, Li and Jiang, 2001).

Little information is available concerning the oestrogenic characteristics of *P. corylifolia* in animal models. Lim *et al.* (2009) investigated whether ethanol extracts of *P. corylifolia* L. (PCE) and its active component protect against bone loss in ovariectomised rats. They screened oestrogenic activities of the main extract fractions using in vitro assays and identified bakuchiol as the most active oestrogenic component by HPLC and LC/MS, and then demonstrated that bakuchiol had strong binding affinity for oestrogen receptor (ER) a. Seventy female Sprague–Dawley rats were assigned to either a sham-operated group (n 10) or an ovariectomised group (n 60). The ovariectomised group was subdivided into six groups, each containing ten rats: vehicle group, two bakuchiol-treated groups (dose of 15 mg/kg per d or 30 mg/kg per d; ten rats for each group), two PCE-supplemented groups (0·25% or 0·5% extracts of diets; ten rats for each group) and a 17b-oestradiol (E2)-treated group (20 mg/kg per d). They recorded weight and feed intake every week, and killed all animals after 6 weeks. Blood was collected, and the uterus, kidneys and livers were removed. Bakuchiol has a three-fold higher binding affinity for ERa than for ERb. Bakuchiol and PCE treatments had no uterotrophic activity even though they demonstrated oestrogenic activity in the in vitro assays. Bakuchiol and PCE treatments reduced postmenopausal bone loss by increasing alkaline phosphatase, Ca concentrations, serum E2 concentration and bone mineral density, and by decreasing the inorganic P level. Their study indicated that bakuchiol and PCE treatments could protect against bone loss. Bakuchiol and PCE treatments may have attenuated bone loss by decreasing the IP levels and by slightly increasing Ca concentration in serum. An increase in BMD was also observed in the proximal femur of ovariectomised rats. Surprisingly, the BH and PH groups exhibited significantly higher BMD than the sham group, and similar BMD to the E2- treated group. The serum E2 concentration was also consistent with the BMD results. Zhang *et al*. reported that PCE inhibits bone resorption in vitro (Zhang *et al*., 2005) and that an acetone extract of *P. corylifolia* significantly increased serum IP and promoted bone calcification in rats (Miura, Nishida and Iinuma, 1996). The study suggested that bakuchiol and PCE supplementation can reduce postmenopausal bone loss without the need for oestrogen. Bakuchiol was the most active component. They concluded bakuchiol as potent phyto-oestrogen and useful alternative to HRT (Lim *et al*., 2009).

One study in rabbits that induced surgical defects in bone tissues but grafted the defect with Psoralea extract (to a concentration around 100 mg/mL water extract) followed for 14 days noted that, under histological examination, new bone tissue was being formed at the Psoralea-Graft interface and quantified to be 275% greater than collagen control (Wong and Rabie, 2010).

In ovariectomized rats (model for menopause), isolated Psoralen was able to increase trabecular thickness over a period of three months relative to control; the mechanisms appear to be related to the Notch signalling pathway (Yang *et al*., 2012). Isolated Bakuchiol as well appears to preserve bone mass in ovariectomized rats at oral dose of 15-30 mg/kg, and although Bakuchiol appears to work via estrogenic means (threefold higher affinity for ERα relative to ERβ, with a 1.34mcg/mL IC_{50} value on the former, it did not increase uterine weight in this study despite an increase in circulating estrogen; (Lim *et al., 2009),* null effects seen elsewhere. The whole seed extract of *P. corylifolia* (50mg/kg daily for 3 months) has also been implicated in increasing bone mineral density in rats (Tsai *et al., 2007),* although when 0.25-0.5% of the rat diet as *P. corylifolia* is compared to an active control of 20mcg/kg estrogen, it underperforms (Lim, *et al., 2009).*

Anti Carcinogenic Activity

P. corylifolia contains bavachinin, corylifolinin, and psoralen all of which inhibit the multiplication of osteosarcoma and lung cancer cells (http://www.mdidea.com). They are also useful in fibrosarcoma, malignant ascites, and leukemia (http://www.cancercliniconline.com).

Topical application of 100 mg/kg body weight of the active fraction (AF) of *P. corylifolia* seeds inhibited the growth and delayed the onset of papilloma formation in mice, initiated with 7,12-dimethyl benz(a) anthracene and promoted using croton oil. The AF at the same dose, when administered orally, inhibited the growth of subcutaneously injected 20-methylcholanthrene (MCA) — induced soft tissue fibrosarcomas significantly. The AF has been shown by gas

chromatography analysis to be composed of a mixture of glycerides of fatty acids (Latha and Panikkar, 1999).

Bakuchiol, one of the major constituent of *P. corylifolia*, has been shown to possess a prominent cytotoxic effect on L929 cells in all cultures. It also showed cytotoxicity against cultured human cell lines, namely, A549, SK-OV-3, SK-MEL-2, XF-498, and HCT-15 (Rastogi and Mehrotra, 1998). Psoralidin, a coumestan derivative isolated from the seeds, showed a cytotoxic effect on stomach cancer cell line with IC50 values of 53 µg/ mL in SNU-1 and 203 µg/mL in SNU-16 (Rajpal, 2005). Byung *et al* showed antitumor and cytotoxic activity of the drug (Khatune *et al*., 2002). Guo *et al.* (2003) proved that psoralen and isopsoralen had antitumor activity against BGC-823 cancer cells. *P. corylifolia* seed extract has been reported to stimulate the immune system in mice. Administration of the seed extract was also found to inhibit EAC ascitic tumor growth and stimulate natural killer cell activity, antibody-dependent cellular cytotoxicity, antibody forming cells, and the antibody complement-mediated cytotoxicity during tumor development (Rajpal, 2005).

The *P. corylifolia* extract appears to have cytotoxic effects in some cancer cells. Bronikowska *et al*. (2012) studied isolated Psoralidin (Coumarin) effect which showed enhanced apoptosis via TRAIL (Tumor Necrosis Factor-related apoptosis-inducing ligand), it is a pathway by which the immune system can selectively destroy tumor cells by releasing TRAIL (expressed on some immune cells) into a soluble form, which then acts on death receptors on cancer cells (Bonavida *et al*., 1999; Szliszka and Krol , 2011; Lee *et al*., 2007).

Psoralidin has also been noted to reverse TRAIL resistance *in vitro* againt cancer cells and appears to overcome cancer cell resistance to TNF-α (Srinivasan *et al.,* 2010) (both TNF-α and TRAIL belonging to the same TNF superfamily) (https://examine.com/supplements/psoralea-corylifolia/).

Reproductive Toxicity

An ethanolic extract of *P. corylifolia* at 0.375, 0.75, 1.5, or 3% of the rat diet by weight for 90 days noted decreases in weight at doses of 0.75% and above accompanied by decreased gonad weight (testes and ovaries) at doses of 1.5-3% of the diet. (Takizawa *et al., 2002)* As a previous study on 8-methoxypsoralen was accompanied by testicular atrophy, (National Toxicology Program report 1989) it was thought that these doses were showing Psoralen-induced reproductive toxicity. Increased yGPT and BUN were also noted at the highest dose (3%) in both sexes, and also at 0.75-1.5% in female rats. One preliminary study in rats suggested that 8g/kg bodyweight Psoralea (estimated human dose of 87g for a 150lb female) could potentially be associated with reproductive toxicity in female pregnant rats (Xu *et al.,* 2012).

Anti-Depressant Activity

There are two studies in rats suggesting a possible anti-stress and anti-depressant effect, although they are not to a remarkable degree. The mechanisms of Bakuchiol and its derivatives are highly catecholamine (dopamine, noradrenaline and adrenaline) based, and there is possibility of interactions between Psoralea and classical stimulants (https://examine.com/supplements/psoralea-corylifolia/).

Chen *et al*. (2007) studied the antidepressant activity of total furanocoumarins present in *P. corylifolia* (TFPC) in the chronic mild stress model of depression in mice. The results revealed that TFPC possess potent and rapid antidepressant properties that are mediated via MAO, the hypothalamic–pituitary–adrenal axis, and oxidative symptoms. Thus, it makes *P. corylifolia*, a potentially valuable drug for the treatment of depression in the elderly. Xu *et al*. (2008) also proved psoralen's antidepressant effects, using forced swimming test model of depression in male mice.

In the forced swim test model in mice, Psoralen at an oral dose of 10, 20, and 40mg/kg for 1, 7, and 14 days noted that the highest dose was associated with anti-depressive effects. Normalizations in serotonin and corticosteroid level at 20mg/kg (with 10 and 40mg/kg underperforming relative to 20mg/kg) suggest an Adaptogen-like effect (Xu *et al*., 2008). *P. corylifolia* furanocoumarins (30-50mg/kg) have been further tested in a model of Chronic stress, and appeared to have anti-stress effects as assessed by serum corticosterones and a sucrose-preference test (Chen *et al., 2007).*

Anti Ageing and Hepato-Protective

It has hepatoprotective properties (http://www.cancercliniconline.com). PCS extract and bakuchiol have been reported to have a protective effect on hepatic injury (Park *et al*., 2005; Cho *et al*., 2001). However, the mechanism of action is not fully understood. Eunhui *et al*. (2013) in their study, examined whether PCS extract has an antioxidant effect and improves mitochondrial function in hepatocytes, as hepatocytes are exposed to large amounts of ROS due to their numerous mitochondria and high respiratory rate. As ROS are known to play a central role in mediating various metabolic disorders related to aging, inhibiting ROS (Reactive oxygen species) production and enhancing ROS scavenging may be useful for treating aging and age-related metabolic disorders. Their study suggested that PCS extract is effective for protecting hepatocytes from ROS toxicity. a better understanding of the response to oxidative stress and mitochondrial regulation in hepatocytes will reveal new therapeutic targets for age associated degenerative diseases. PCS extract may be a beneficial plant-based dietary component to counteract oxidative stress-induced disease or aging (Eunhui *et al*., 2013). Therefore, modulation of these age-associated mitochondrial changes may slow the aging process and prevent or delay age-related diseases. PCS has been used traditionally as a medicine in Asia and are known to have antioxidant activity (Haraguchi *et al*., 2002; Jiangning *et al*., 2005; Jan *et al*., 2012).

In particular, a component of PCS has liver detoxifying and hepato-protective effects (Park *et al*., 2005; Cho *et al*., 2001; Park *et al*., 2007). The accumulation of oxidative damage and mitochondrial dysfunction is an important factor that contributes to aging.

The glucoside of the isoflavonoid, diadzein, called diadzin, inhibits the enzymes alcohol dehydrogenase and NAD-dependent alcohol aldehyde dehydrogenase. These enzymes catalyse the oxidation of acetaldehyde, the primary product of alcohol metabolism. So, when diadzin is present, alcohol levels in the bloodstream increase and cannot be metabolized by the

enzymes. An important consequence of this is that alcoholics soon lose their appetite for alcohol (Peter, 1998).

The water-soluble extract containing bakuchiol has been found to possess hepatoprotective activity in tacrine-induced cytotoxicity in human liver-derived HepG2 cells. The EC50 value of bakuchiol was 1 µg/mL and of silymarin was 5 µg/mL (Rajpal, 2005).

Twelve compounds were isolated from *P. corylifolia* and their structures were identified as isopsoralen (1), psoralen (2), 8-methoxypsoralen (3), psoralidin (4), corylin (5), bavachin (6), daidzein (7), corylifolinin (8), bavachinin (9), neobavaisoflavone (10), daidzin (11) and astragalin (12). The results showed that psoralidin had the activity of scavenging DPPH free radicals activity (IC50 43.85 mg x L(-1)). Psoralidin (IC50 1.32 mg x L(-1))c, oryfolin (IC50 4.97 mg x L(-1)), daidzin (IC50 10.47 mg x S(-1)), daidzein (IC50 34.22 mg) x L(-1)) and astragalin (IC50 31.27 mg x L(-1)) had the activity of scavenging ABTS free radical. Psoralidin (IC50 40.74 mg x L(-1)), coryfolin (IC50 45.73 mg x L(-1)) and daidzein (IC50 49.44 mg x L(-1)) had alpha-glucosidase inhibitory activity. Corylifolinin and neobavaisoflavone had significantly effect of inhibiting SA, MRSA and ESBLs-SA (MIC 0. 781 3, 1.562, 5, 0.781 25 microg x disc(-1) and 6.25, 6.25, 6.25 microg x disc(-1) (Wang *et al* ., 2013).

Anti Inflammatory Activity

Bavachinin A isolated from fruits revealed a marked anti-inflammatory, antipyretic, and mild analgesic properties at a dose of 25–100 mg/kg. It has demonstrated better antipyretic activity than paracetamol and showed no effect on the central nervous system, and the maximum lethal dose was greater than 1000 mg/kg in mice (Rajpal, 2005). Several flavonoids from P. corylifolia might be useful remedies for treating inflammatory diseases by inhibiting IL-6-induced STAT3 activation and phosphorylation (Lee *et al.,* 2012). It also showed anti-inflammatory activity against carrageenan-induced edema in rats (Kapoor, 2001).

Skin Related Problem/ Leucoderma

Vitiligo is a skin condition, which is characterized by white patches on the skin. This condition is caused by immune system problems. There is no specific cure for vitiligo, but there are many ways in which the symptoms can be controlled. The most effective home remedy for vitiligo recommended by doctors and other health experts is the use of herbal components that contain psoralens. There are several natural products, which contain psoralen, like celery, parsley, West Indian satinwood and figs (http://www.home-remedies-for-you.com/askquestion/3682/what-are-the-benefits-and-side-effects-of-babchi-oil.html).

Rashid Ali and Agarwal showed that psoralen accelerates the photooxidation of DOPA under sunlight as well as photo flood lamplight (Kapoor, 2001).

Topical application of active fraction from seeds inhibited the growth and delayed the onset of papilloma formation (Gupta, Neeraj and Madhu, 2005). Psoralen, when orally taken by rabbit at a dose of 4 mg/g and exposed in sun, there was pigment deposition. The furanocoumarins, which contain psoralens, promote pigmentation (Sebastian, 2006). The powder is used by Vaidyas internally for leprosy and leukoderma and externally in the form of paste and ointment (Panda, 2000; Nadkarni, 1976). It is used in the inflammatory diseases, mucomembranous disorders, dermatitis, and edematous conditions of the skin (Sharma, Yelne and Dennis, 2001; http://www.wikipedia.com ; Rajpal, 2005). It also alleviates boils and skin eruptions. The plant has blood purifying properties. It is used to treat itching red papules, itching eruptions, extensive eczema with thickened dermis, ringworm, rough and discolored dermatosis, dermatosis with fissures, and scabies (Khare, 2004).

Other Uses

Seeds are used to make perfumed oil (Nadkarni, 1976). The ethanolic extract has been used as a food additive for the preservation of some processed foods or pickles in Japan (Qiao *et al.*, 2007). The seed cake rich in nitrogen and minerals is used as feed or manure (Krishnamurthi *et al*., 1969).

Negative Effects

The potential hepatotoxicity of herbal remedies is usually ignored in daily life. *P. corylifolia* appeared to be associated with the occurrence of acute cholestatic hepatic injury. Some alternative medicine therapists claim that P. corylifoliais effective for the treatment of osteoporosis. They observed a case of acute cholestatic hepatitis associated with the use of the seeds of *P. corylifolia* in amounts over 10 times the usual dose in a postmenopausal woman. Liver biopsy showed zone three necroses, degenerating cells, cholestasis, and infiltrations with inflammatory cells. This case stresses the need to warn of the potential hepatotoxicity of the seed of *P. corylifolia*, especially in a large dose (Nam *et al*., 2005).

Fructus Psoraleae (FP) is used by herbalists for the treatment of postmenopausal osteoporosis, vitiligo, and psoriasis. It is used alone, or in combination with other herbs, in some countries in the form of proprietary medicine. It is recognized as one of the emerging hepatotoxins and they reported three cases of acute hepatitis after exposed to FP and its related proprietary medicine. They suggested psoralen and its related chemicals may be responsible for the hepatotoxicity. Decoction with other herbs may result in higher concentration of toxic constituents and in more severe liver injury. FP is associated with hepatotoxicity in some individuals. Pharmaco-vigilance for the potential side effects of herbal products is necessary (Cheung *et al*., 2009).

CONCLUSION

Psoralea corylifolia is an important medicinal plant with thousands of years of clinical application. The plant parts have been used in leukoderma, psoriasis, vitiligo, asthma, ulcers, and kidney disorders. It contains various pharmacologically important compounds. The plant could be very beneficial as a daily novel food or can be promoted for its medicinal properties and more research areas could be explored based on its pharmacological properties.

References

1. Agharkar SP (1991), Medicinal Plants of Bombay Presidency; India: Scientific Publishers, pp. 176–7.
2. Aslan M, Orhan N, Orhan DD and Ergun F (2010), “Hypoglycemic activity and antioxidant potential of

some medicinal plants traditionally used in Turkey for diabetes", *J Ethnopharmacol*, Vol. 128(2), pp.384–389.
3. Bonavida B, Ng CP, Jazirehi A, Schiller G and Mizutani Y(1999), "Selectivity of TRAIL-mediated apoptosis of cancer cells and synergy with drugs: the trail to non-toxic cancer therapeutics (review)", *Int J Oncol*, Vol. 15(4), pp.793-802.
4. Bronikowska J, Szliszka E, Jaworska D, Czuba ZP and Krol W *(2012),* "The coumarin psoralidin enhances anticancer effect of tumor necrosis factor-related apoptosis-inducing ligand (TRAIL)",*Molecules*, Vol.17(6), pp. 6449-64
5. Buyukbalci A and Sedef Nehir EI (2008), "Determination of in vitro antidiabetic effects, antioxidant activities and phenol contents of some herbal teas", *Plant Foods Hum Nutr*, Vol. 63(1), pp.27–33.
6. Chanda S, Kaneria M and Nair R (2011), "Antibacterial Activity of P. corylifoliaL. Seed and Aerial Parts with Various Extraction Methods", Research Journal of Microbiology, Vol. 6.2 , pp. 124-131.
7. Chen Y, Wang HD, Xia X, Kung HF, Pan Y and Kong LD (2007), "Behavioral and biochemical studies of total furocoumarins from seeds of *P. corylifolia*in the chronic mild stress model of depression in mice", *Phytomedicine*, Vol.14, pp.523–9.
8. Cheng ZW, Cai XF, Dat NT, Hong SS, Han AR, Seo EK, Hwang BY, Nan JX, Lee D and Lee JJ (2007), "Bisbakuchiols A and B, novel dimeric meroterpenoids from *Psoralea corylifolia*", *Tetrahedron Lett,* Vol. *48*, pp.8861–8864.
9. Cheung WI, Tse ML, Ngan T, Lin J, Lee WK, Poon WT, Mak TW, Leung VK and Chau TN (2009), "Liver injury associated with the use of Fructus Psoraleae (Bol-gol-zhee or Bu-gu-zhi) and its related proprietary medicine", *Clin Toxicol* (*Phila*), Vol. 47(7), pp. 683-5.
10. Cho H, Jun J-Y, Song E-K *et al*. (2001), "Bakuchiol: a hepatoprotective compound of *P. corylifolia*on tacrine-induced cytotoxicity in hep G2 cells," *Planta Medica*, Vol. 67(8), pp. 750–751.
11. Chopra RN, Chopra IC (1958), Indigenous Drugs of India; 2nd ed. Kolkata: Academic Publishers, pp. 391–4.
12. Eunhui Seo, Yoon Sin Oh, Donghee Kim, Mi-Young Lee, Sungwook Chae, and Hee-Sook Jun (2013), "Protective Role of *P. corylifolia* L. Seed Extract against Hepatic Mitochondrial Dysfunction Induced by Oxidative Stress or Aging", *Hindawi Publishing Corporation, Evidence-Based Complementary and Alternative Medicine*, Article ID 678028, 9 pages.
13. Fazelian M and Eslami B (2009), "In vitro antioxidant and free radical scavenging activity of Diospyros lotus and Pyrus boissieriana growing in Iran", *Pharmacogn Mag*, Vol. 5(18), pp.122–126.
14. Ferra´ndiz ML, Gil B, Sanz MJ, Ubeda A, Erazo S, Gonza´lez E, Negrete R, Pacheco S, Paya´ M and Alcaraz MJ (1996), "Effect of bakuchiol on leukocyte functions and some inflammatory responses in mice", *J Pharm Pharmacol*, Vol. 48, pp. 975–980.
15. Guo J, Hou W, Xinchu W, Jianhua Y and Kaishun B (2003), "Studies on extraction and isolation of active constituents from *P. corylifolia* L.and the antitumor effect of the constituents in vitro", *Zhong Yao Cai*, Vol. 23, pp.185–7.
16. Guo J, Weng X, Xinchu W, Hou W, Qinghua L and Kaishun B (2005), "Antioxidants from Chinese medicinal herb-*P. corylifolia* L", *Food Chem*, Vol. 91, pp. 87–92.
17. Guo JN, Weng XC, Wu H, Li QH and Bi KS (2005), "Antioxidants from a Chinese medicinal herb—*P. corylifolia* L", *Food Che,* Vol. *91*, pp. 287–292.
18. Gupta AK, Neeraj T and Madhu S (2005), Quality Standards of Indian Medicinal Plants, New Delhi: ICMR, Vol. 3, pp. 290–8.
19. Haraguchi H, Inoue J, Tamura Y and Mizutani K (2002), "Antioxidative components of P. corylifolia(Leguminosae)", *Phytother Res*, Vol. 16, pp. 539–544.
20. http://www.cancercliniconline.com
21. http://www.herbsguide.net
22. http://www.home-remedies-for-you.com/askquestion/3682/what-are-the-benefits-and-side-effects-of-babchi-oil.html.
23. http://www.india-shopping.net .
24. http://www.mdidea.com .
25. http://www.motherherbs.com .
26. http://www.wikipedia.com
27. https://examine.com/supplements/psoralea-corylifolia/
28. Jan S, Parween T, Siddiqi TO *et al*, (2012) "Anti-oxidant modulation in response to gamma radiation induced oxidative stress in developing seedlings of *P. corylifolia* L," *Journal of Environmental Radioactivity*, Vol. 113, pp. 142–149, 2012.
29. Jiangning G, Xinchu W, Hou W, Qinghua L, and Kaishun B (2005), "Antioxidants from a Chinese medicinal herb—*P. corylifolia*L," *Food Chemistry*, Vol. 91 (2), pp. 287–292.
30. Joshi N, Caputo GM, Weitekamp MR and Karchmer AW (1999), "Infections in Patients with Diabetes Mellitus", *N Engl J Med*, Vol. 341(25), pp.1906–1912.
31. Joshi SG (2000), Medicinal Plants, New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd pp. 206–7.
32. Kapoor LD. Boca Raton, Florida: CRC Press (2001), "Handbook of Ayurvedic Medicinal Plants", pp. 274–5.
33. Karsura H, Tsukiyama RI, Suzuki A and Kobayashi M (2001), "In vitro antimicrobial activities of bakuchiol against oral microorganisms", *Antimicrob Agents Chemother,* Vol. 45, pp. 3009–3013.
34. *Kaufman PB, Duke JA, Brielmann H, Boik J and Hoyt JE (1997), "A comparative survey of leguminous plants as sources of the isoflavones, genistein and daidzein: Implications for human nutrition and health", Journal of alternative and complementary medicine, Vol. 3(1), pp. 7–12. .*
35. Khare CP (2004), Encyclopedia of Indian Medicinal Plants; New York: Springer-Verlag, pp. 384–6.
36. Khatune NA, Islam ME, Haque ME, Khondkar P and Rahman M M (2004), "Antibacterial compounds from the seeds of *Psoralea corylifolia*," *Fitoterapia*, Vol. 75 (2), pp. 228–230,
37. Khatune NA, Islam ME, Rahman MA, Baki MA, Sadik G and Haque MA (2002), "Pesticidal activity of a novel coumestan derivative isolated from *P. corylifolia*L.

against Tribolium castaneum Herbst. adults and larvae" *Pak J Agron*, Vol.1, pp.112–5.
38. Khushboo PS, Jadhav VM, Kadam VJ, and Sathe NS (2010), *"P. corylifolia* Linn.—"Kushtanashini", *Pharmacogn Rev*, Vol. 4(7), pp. 69–76.
39. Krishnamurthi AK, Manjunath BL, Sastri BN, Deshaprabhu SB and Chadha YR (1969), The Wealth of India: Raw Materials, New Delhi: CSIR, Vol. 7, pp. 295–8.
40. Latha PG and Panikkar KR (1999), "Inhibition of chemical carcinogenesis by *P. corylifoliaseeds", Journal of Ethnopharmacology*, Vol. 68(1–3), pp. 295–298
41. Latha PG, Evans DA, Panikkar KR and Jayavardhanan KK (2000), "Immunomodulatory and antitumour properties of *P. corylifolia* seeds", *Fitoterapia,* Vol. 71, pp. 223–231.
42. Lee JY, Huerta-Yepez S, Vega M, Baritaki S, Spandidos DA and Bonavida B (2007), "The NO TRAIL to YES TRAIL in cancer therapy (review)", *Int J Oncol*, Vol.31(4), pp.685-91.
43. Lee SW, Yun BR, Kim MH, Park CS, Lee WS, Oh HM and Rho MC (2012), "Phenolic compounds isolated from Psoralea corylifolia inhibit IL-6-induced STAT3 activation", *Planta Med*, Vol. 78(9), pp. 903-6.
44. Lim SH, Ha TY, Ahn J and Kim S(2011), "Estrogenic activities of *P. corylifolia* L. seed extracts and main constituents", *Phytomedicine,* Vol. 18, pp. 425–430.
45. Lim SH, Ha TY, Kim S R, Ahn J, Park HJ and Kim S (2009), "Ethanol extract of P. corylifoliaL. and its main constituent, bakuchiol, reduce bone loss in ovariectomised Sprague–Dawley rats British", *Journal of Nutrition,* Vol. 101, pp. 1031–1039.
46. Lin CF, Yu-Ling H, Mei-Yin C, Shuenn-Jyi S and Chien-Chin C (2007), "Analysis of Bakuchiol, Psoralen and Angelicin in crude drugs and commercial concentrated products of Fructus Psoraleae", *J Food Drug Anal*, Vol. 15, pp. 433–7.
47. Miura H, Nishida H and Iinuma M (1996), "Effect of crude fractions of P. corylifoliaseed extract on bone calcification", *Planta Med*, Vol. 62, pp. 150–153.
48. Mukherjee PK, New Delhi: Business Horizons (2002), Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals, pp. 761–3.
49. Nadkarni KM (1976), Indian Materia Medica; Mumbai: Popular Prakashan Pvt. Ltd, Vol. 1, pp. 1019–22.
50. Nam SW, Baek JT, Lee DS, Kang SB, Ahn BM and Chung KW (2005), "A case of acute cholestatic hepatitis associated with the seeds of P. corylifolia (Boh-Gol-Zhee)", *Clin Toxicol* (*Phila*), Vol. 43(6), pp. 589-91.
51. National Toxicology Program Toxicology and Carcinogenesis Studies of 8-Methoxypsoralen (CAS No. 298-81-7) in F344/N Rats (Gavage Studies) . *Natl Toxicol Program Tech Rep Ser* (1989), 359, pp.1-130.
52. Panda H (2000), Herbs, Cultivation and Medicinal Uses; New Delhi: National Institute of Industrial Research, pp. 479–81.
53. Park E-J, Zhao Y-Z, Kim Y-C and Sohn D H (2005), "Protective effect of (S)-bakuchiol from *P. corylifolia*on rat liver injury *in vitro* and *in vivo*," *PlantaMedica*, Vol. 71(6), pp. 508– 513.
54. Park E-J, Zhao Y-Z, Kim Y-C, and Sohn DH (2007), "Bakuchiolinduced caspase-3-dependent apoptosis occurs through c-Jun NH2-terminal kinase-mediatedmitochondrial translocation of Bax in rat livermyofibroblasts," *European Journal of Pharmacology*, Vol. 559(2-3), pp. 115–123.
55. Peter BK. Boca Raton, Florida: CRC Press (1998), "Natural Products from Plants", pp. 105–6.
56. Prasad N R, Anandi C, Balasubramanian S and Pugalendi K V (2004), "Antidermatophytic activity of extracts from *P. corylifolia* (Fabaceae) correlated with the presence of a flavonoid compound," *Journal of Ethnopharmacology*, Vol. 91(1), pp. 21– 24.
57. Qiao CF, Han QB, Mo SF, Song JZ, Xu LJ, Chen SL, *et al*. (2006), "Psoralenoside and Isopsoralenoside, two new benzofuran glycosides from *Psoralea corylifolia*", *Chem Pharm Bull*, Vol. 54, pp. 714–6.
58. Qiao CF, Han QB, Song JZ, Mo SF, Kong LD, Kung HF, *et al*. (2007), "Chemical fingerprint and quantitative analysis of fructus psoraleae by high-performance liquid chromatography", *J Sep Sci*, Vol. 30, pp.813–8.
59. Qu H-B, Wang Y, Hong C, Zhou C, and Xu D (2011), "Screening antitumor compounds psoralen and isopsoralen from *P. corylifolia*L. seeds," *Evidence-based Complementary and Alternative Medicine*, vol. 2011, Article ID 363052.
60. Rajpal V (2005), Standardization of Botanicals, New Delhi: Eastern Publishers, Vol. 2, pp. 284–95.
61. Rastogi RP and Mehrotra BN (1998), Compendium of Indian Medicinal Plants, Lucknow, CDRI and New Delhi: NISCIR, Vol. 5, pp. 703–4.
62. Ruan B, Kong LY, Takaya Y and Niwa M (2007), "Studies on chemical constituents of *P. corylifolia*L", *J Asian Nat Prod Res*, Vol. 9, pp. 41–4.
63. Sebastian P (2006), Ayurvedic Medicine: The Principles of Traditional Practice, New York: Elsevier Health Sciences, Vol. 2, pp. 135–6.
64. Sharma PC, Yelne MB and Dennis TJ (2001), Database on Medicinal Plants used in Ayurveda, New Delhi: Central Council for Research in Ayurveda and Siddha, Vol. 2, pp. 89–93.
65. Srinivasan S, Kumar R, Koduru S, Chandramouli A and Damodaran C (2010), " Inhibiting TNF-mediated signaling: a novel therapeutic paradigm for androgen independent prostate cancer", *Apoptosis*, Vol.15(2), pp.153-61
66. Szliszka E and Krol W (2011), "The role of dietary polyphenols in tumor necrosis factor-related apoptosis inducing ligand (TRAIL)-induced apoptosis for cancer chemoprevention", *Eur J Cancer Prev*, Vol.20 (1), pp.63-9.
67. Takizawa T, Imai T, Mitsumori K, Takagi H, Onodera H, Yasuhara K, Ueda M, Tamura T and Hirose M (2002), Gonadal toxicity of an ethanol extract of P. corylifoliain a rat 90-day repeated dose study", *J Toxicol Sci*, Vol. 27(2) pp.97-105.
68. *Tang SY, Gruber J, Wong KP and Halliwell B (2007), "P. corylifoliaL. inhibits mitochondrial complex I and proteasome activities in SH-SY5Y cells", Annals of the New York Academy of Sciences, Vol. 1100, pp. 486–96.*

69. *Teschke R and Bahre R (2009), "Severe hepatotoxicity by Indian Ayurvedic herbal products: A structured causality assessment", Annals of Hepatology, Vol. 8 (3), pp. 258–66.*
70. Tsai MH, Huang GS, Hung YC, Bin L, Liao LT and Lin LW (2007), "P. corylifolia extract ameliorates experimental osteoporosis in ovariectomized rats", *Am J Chin Med*, Vol.35(4), pp.669-80.
71. Tsai WJ, Hsin WC and Chen CC (1996), "Antiplatelet flavonoids from seeds of *Psoralea corylifolia*.", *J. Nat. Prod,* Vol. *59*, pp. 671–672.
72. Wang D, Li F and Jiang Z (2001), "Osteoblastic proliferation stimulating activity of P. corylifoliaextracts and two of its flavonoids", *Planta Med*, Vol.67, pp.748–749.
73. Wang TX, Yin ZH, Zhang W, Peng T and Kang WY (2013), "Chemical constituents from P. corylifolia and their antioxidant alpha-glucosidase inhibitory and antimicrobial activities", *Zhongguo Zhong Yao Za Zhi*., Vol. Jul,38(14), pp.2328-33.
74. Wang X, Wang Y, Yuan J, Sun Q, Liu J and Zheng C (2004), "An efficient new method for extraction, separation and purification of psoralen and isopsoralen from Fructus Psoraleae by supercritical fluid extraction and high-speed counter-current chromatography", *J. Chromatogr. A,* Vol. *1055*, pp. 135–140.
75. Wong RW and Rabie AB (2010), "Effect of Buguzhi (P. corylifoliafruit) extract on bone formation" *Phytother Res, Vol.* 24 Suppl 2, pp.S155-60.
76. Xiao G, Li G, Chen L, Zhang Z, Yin JJ, Wu T, Cheng Z, Wei X and Wang Z (2010), "Isolation of antioxidants from P. corylifolia fruits using high-speed counter-current chromatography guided by thin layer chromatography-antioxidant autographic assay", *J Chromatogr A.*, Vol. 1217(34), pp. 5470-6.
77. Xin D, Wang H, Yang, J, Su Y-F, Fan G-W, Wang Y-F, Zhu Y and Gao X-M (2010), " Phytoestrogens from *P. corylifolia* reveal estrogen receptor-subtype selectivity", *Phytomedicine,* Vol. 17(2), pp. 126–131.
78. Xu M, Tian XY, Leung KS, Lee, KC, Chow TC *et al.* (2012), "Embryotoxicity of P. corylifoliaL.: In Vivo and In Vitro Studies", . *Birth Defects Res B Dev Reprod Toxicol*, Vol.95(6) pp.386-94
79. Xu Q, Pan Y, Yi LT, Li YC, Mo SF, Jiang FX, *et al*. (2008), "Antidepressant-like effects of psoralen isolated from *P. corylifolia*in the mouse forced swimming test", *Biol Pharm Bull*, Vol.31, pp.1109–14.
80. Yadava RN and Verma YA (2005), "A new biologically active flavonol glycoside from P. corylifolia(Linn.)", *J Asian Nat Prod Res,* Vol. 7, pp. 671–675.
81. Yang WM, Chang MS, and Park S K (2008), "Effects of *P. corylifolia*on the cAMP-responsive element modulator (CREM) expression and spermatogenesis in rats," *Journal of Ethnopharmacology*, Vol. 117(3), pp. 503–506.
82. Yang Z, Huang JH, Liu SF, Zhao YJ, Shen ZY, Wang YJ, Bian Q(2012), "The osteoprotective effect of psoralen in ovariectomy-induced osteoporotic rats via stimulating the osteoblastic differentiation from bone mesenchymal stem cells", *Menopause* Vol.19(10), pp. 1156-64.
83. Yanmei Cui, Shoko Taniguchi, Teruo Kuroda and Tsutomu Hatano (2015), "Constituents of *P. corylifolia* Fruits and Their Effects on Methicillin-Resistant *Staphylococcus aureus", Molecules,* Vol. *20*, pp. 12500-12511.
84. Yin S, Fan CQ, Wang Y, Dong L and Yue JM (2004), "Antibacterial prenylflavone derivatives from *Psoralea corylifolia*, and their structure–activity relationship study", *Bioorg Med Chem,* Vol. *12*, pp. 4387–4392.
85. Zhang CZ, Wang SX, Zhang Y, Chen JP and Liang XM (2005), "In vitro estrogenic activities of Chinese medicinal plants traditionally used for the management of menopausal symptoms", *J Ethnopharmacol*, Vol. 98, pp.295–300.
86. Zhang X, Zhao W, Wang Y, Lu J and Chen X (2016), "The Chemical Constituents and Bioactivities of P. corylifolia Linn.: A Review", *Am J Chin Med*., Vol. 44(1), pp.35-60.
87. *Zhao G, Li S, Qin GW, Fei J and Guo LH (2007), "Inhibitive effects of Fructus Psoraleae extract on dopamine transporter and noradrenaline transporter", J Ethnopharmacol, Vol. 112 (3), pp.498–506.*
88. *Zhao LH, Huang CY, Shan Z, Xiang BG and Mei LH (2005), "Fingerprint analysis of P. corylifoliaby HLPC and LC-MS", J Chromatogr B, Vol. 821, pp.67–74.*
89. Zhao LH, Wu MH and Xiang BR (2005), "Analysis of *P. corylifolia* L. fruits in different regions", *Chem Pharm Bull*, Vol. 53, pp.1054–7.

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