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CHEMICAL CONSTITUENTS AND PHARMACOLOGICAL IMPORTANCE OF *BIDENS TRIPARTITUS* - A REVIEW

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ABSTRACT

Thephytochemical analysis of *Bidens tripartitus* revealed the presence of flavonoids, xanthophylls, volatile oil, acetylene, polyacetylene, sterols, aurones, chalcones, caffeine, anthracene derivatives, triterpenes, coumarins, anthocyanosides, tannins and many other secondary metabolites. It exerted antibacterial, antioxidant, anticancer, anti-inflammatory, analgesic, antipyretic, antimalerial, gastrointestinal, anti-psoriasis and many other pharmacological effects. This review highlights the chemical constituents and pharmacological effects of *Bidens tripartitus*.

Keywords: *Bidens tripartitus*, Pharmacology, Chemical constituents, Medicinal plant, Review.

INTRODUCTION

Plant derivates had been employed by populations to prevent different kind of diseases for centuries. The knowledge of plant properties was acquired by ancient civilization that passed down from generation to generation until today.Plants are a valuable source of a wide range of secondary metabolites, which are used as pharmaceuticals, agrochemicals, flavors, fragrances, colors, pesticides and food additives[1-61]. The phytochemical analysis of *Bidens tripartitus*r evealed the presence of flavonoids, xanthophylls, volatile oil, acetylene, polyacetylene, sterols, aurones, chalcones, caffeine, anthracene derivatives, triterpenes, coumarins, anthocyanosides, tannins and many other secondary metabolites. It exerted antibacterial, antioxidant, anticancer, anti-inflammatory, analgesic, antipyretic, antimalerial, gastrointestinal, anti-psoriasis and many other pharmacological effects. This review will highlight the chemical constituents and pharmacological effects of *Bidens tripartitus*.

Synonyms

Bidensacuta (Wiegand) Britton, *B. comosa*(Gray.) Wieg.,*B. connate* Muhl. exWilld., *B. hirta* Jordan in Gren. &Godr., *B. nodifl ora* L., *B. Nodifl ora* Lév. &Vaniot, *B. shimadai*H ayata, *B. taquetii* Lev. &Van., *B. tripartia* L., *Hepatorium* sp[62-64].

Taxonomic classification

Kingdom: Plantae; Subkingdom:Tracheobionta; Superdivision: Spermatophyta; Division: Magnoliophyta; Class: Magnoliopsida; Subclass: Asteridae; Order: Asterales; Family: Asteraceae/Compositae; Genus: Bidens L.; Species: *Biden stripartita L*[65-66].

Common names

Arabic: ekhewanshaiek, kinabmaei, telmaei; English: Bur-marigold, marigold-bur, trifid bur-marigold, water-agrimony; German: dreiteiliger Zweizahn; Zswedish: brunskära[66].

Distribution

The plant is found in damp regions throughout Europe, Asia, Africa, Australia, New Zealand and North America [65]. Today, the plant is distributed inAfrica:Algeria; Asia: Afghanistan, Iran, Iraq; Palestine, Syria, Turkey, Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Mongolia, Russian Federation, China, Japan, Korea North, Korea South, Taiwan, Bhutan, India, Nepal, Pakistan, Indonesia, Malaysia, Philippines, Europe: Denmark, Finland, Ireland, Norway, Sweden, United Kingdom, Austria, Belgium, Czech Republic, Germany, Hungary, Netherlands, Poland, Slovakia, Switzerland, Belarus,

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Estonia, Latvia, Lithuania, Moldova, Russian Federation, Macedonia, Montenegro, Romania, Serbia, Slovenia, France, Portugal, Spain; Northern America: USA, Canada; Australia: Australia, New Zealand [66].

Traditional use

It was used as a diuretic, sudorific, anti-inflammatory agent and to stimulate the immunological system. Bur-marigold herb is also a remedy for ruptured blood vessels and bleeding of every description. In addition, it was used in the treatment of skin diseases, in treating fevers, gravel, stone, bladder and kidney troubles[68-69]. It was also used for wound-healing, for treatment of diseases of the liver, spleen, bronchitis, diabetes, poor digestion, colds, as a diuretic and diaphoretic and to improve digestion [70].

Description

Annuals, (5–)20–70(–200) cm. Leaves sessile or petioles 5–15(–35+) mm (± winged); blades ± elliptic to ovate or lanceolate, 40–80(–150+) × 15–40(–60+) mm, sometimes laciniately 1-pinnatisect with 1–4+ lobes near bases, bases cuneate, margins entire or dentate to serrate, usually ciliate, apices acute to acuminate, faces glabrous or hirtellous. Heads borne singly or in 2s or 3s.Peduncles 10–40(–80) mm. Calyculi of (2–)6–7(–10) ± spreading, oblanceolate or lanceolate to linear, ± foliaceousbractlets or bracts 7–35(–60) mm, margins (entire or serrate) sometimes sparsely ciliate, abaxial faces hispidulous near bases, distally glabrous. Involucrescampanulate to hemispheric or broader, (4–)5–7(–12) × (3–)6–12(–15+) mm. Phyllaries (6–)7–8(–13), elliptic-ovate to lance-ovate, (4–)6–9(–12) mm. Ray florets usually 0, sometimes 1–5; laminae orange yellowish, 4–8 mm. Disc florets (5–)20–60(–150+); corollas pale yellow to orange, (2–)3–4 mm (gradually ampliate, anthers usually pale). Cypselae blackish to purplish or brown, ± flattened, sometimes weakly 3(–4)-angled, usually cuneate to linear, outer (3–)6–7(–10) mm, inner (4–)6–9(–11) mm, margins proximally antrorsely to patently, distally retrorsely, barbed, apices ± truncate to concave, faces ± 1-nerved, usually smooth, seldom notably tuberculate, glabrous or sparsely strigillose; pappi 0, or of (1–)3–3(–4+) ± erect to spreading, retrorsely barbed awns (0.2–)2–3(–6) mm [71].
Part used: The whole Bur Marigold plant is used medicinally[65].

Chemical constituents

Phytochemical studies on *Bidens tripartita* herb showed the presence of flavones, flavanones, chalcones, aurones, coumarins, small amounts of vitamin C, carotenoids and a volatile oil [72-73].

However, extensive phytochemical studies on *Bidens tripartita* have shown the presence of flavonoids, coumarins, essential oil, polysaccharides, carotenoids, lactones, amines and mineral elements. In the petroleum extract of the herb of *Biden stripartita*, triterpenes, unsaturated aliphatic hydrocarbons, esters of fatty acids and sterols, with dominating stigmasterol, were identified. The green parts of *Biden stripartita* afforded the identification of polyacetylenic compounds, linoleic acid and ocimene [73-80]**.**

However, Sandu*et al.*, isolated flavonoids, xanthophylls, volatile oil, acetylene and polyacetylene, sterols, aurones, chalcones, caffeine, anthracene derivatives, triterpenes, coumarins, antocyanosides and tannins from the plant flowers [81-82]. While, Pozharitskaya *et al*., isolated flavonoids, tannins, polysaccharides, phenols, amino acids, ascorbic acid, organic acids and polyacetylenes from the aerial parts of the plant [83].

The chemical composition of the essential oil of the roots of *Biden stripartita* was investigated by gas chromatography-mass spectrometry. In total, 106 compounds identified (97.1% of the total oil). The main components of the oil were α-pinene (15.0%), β-bisabolene (9.3%), p-cymene (6.0%), hexanal (5.7%), linalool (4.6%), p-cymene-9-ol (3.4%), β-elemene (2.6%), 2-pentylfuran (2.2%), and silphiperfol-6-ene (2.1%) [84].

The content of flavonoids in flower heads is half of that found in the herb. The main flavonoid constituents of the extracts are 7-Oglucosides of isookanin, luteolin and tridecane derivatives such as trideca-l,12-dien-3,5,7,9-tetrain. Flavanomarein dominates in flowers and cynaroside in green parts of this plant. The content of flavonoids, according to the Christ-Mulleris method, was 1.85% in the *B. tripartite* herb and to 0.92% in the *Biden stripartita* flowers. Hydroxycoumarins contents included umbelliferone and scopoletin, while polyynes (tridecane derivatives) included trideca-I, 12- dien-3,5,7,9-tetrain**.** Volatile oil isolated from the plant included eugenol, ocimene, cosmene [58,67]

Pharmacological effects

Antioxidant and anticancer effects

Extracts from herb and flowers of *Biden stripartita* L. using solvents of different polarity, were studied for their radical scavenging effects. Antioxidant activities of pure flavonoids: flavanomarein (isookanin 7-O-glucoside), cynaroside (luteolin 7-O-glucoside) and luteolin, which had been isolated from this plant, were also evaluated. Radical-scavenging activity was measured by electron paramagnetic resonance (EPR) spectroscopy using stable 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical.Some extracts (*n*-Butanol fraction) showed long lasting radical scavenging activity. Scavenging of DPPH showed second-order kinetics at the beginning of the assay period and later the first-order one. Different kinetics suggested the presence of polymerized and/or less active antioxidants with different scavenging mechanisms for particular polyphenolic compounds. *Biden stripartita* extracts were potential source of natural antioxidants that may be used in

pharmaceutical or food industry [68].The methylene chloride extract of *Biden stripartita* has demonstrated to have high activity in the inhibition of cancer L1210 (mouse leukemia) cells and against thrombin [72].

Antimicrobial effects

The antibacterial and antifungal properties of the essential oil were evaluated against eight Gram-positive and 11 Gram-negative bacterial species and 10 fungal strains. The oil exhibited a strong antifungal activity [84].

Twelve extracts and two essential oils of *Biden stripartita* were investigated for activity against different Gram-positive *Bacillus subtilis*, *Micrococcus luteus*, *Staphylococcus aureus*, Gram-negative bacteria *Escherichia coli*, *E. coli* (β-lactamase+), *Klebsiella pneumonia* (ESBL+), *Pseudomonas aeruginosa* and some fungal organisms *Candida albicans, C. parapsilosis, Aspergillus fumigatus, A. terreu* susing a broth microdilution and disc diffusion methods. The results obtained indicate antimicrobial activity of the tested extracts (except butanolic extracts), which however did not inhibit the growth of fungi used in this study. Bacteriostatic effect of both essential oils is insignificant, but they have strong antifungal activity [85].

Anti-inflammatory antipyretic analgesic effect

The anti-inflammatory potential of three doses of an aqueous infusion of aerial parts *Biden stripartita* L. was investigated against carrageenan-induced acute paw edema in rats. Infusion doses of 20ml/k bw exhibited significant anti-inflammatory activity in rats, as compared with indomethacin. In addition, the infusion showed analgesic properties in a hot-plate test and antipyretic properties in carrageenan-induced local hyperthermia in rats. The effects were dose-dependent [83].

Gastrointestinal effects

Intragastric administration of methanolic and aqueous extracts of the aerial parts of *Bidens tripartite* (500 mg/kg bw) to rats showed antiulcer activity against aspirin-induced, but not indomethacin-induced ulcers [86].

The crude flavonoids isolated from the aerial parts of the plant (500 mg/kg body weight bw orally) were significantly induced choleretic activity. It also caused an increase of cholic acids and cholesterol in bile [87].

500 patients with dysentery, 65 with acute enteritis and 248 with chronic enteritis were used the aerial parts of the plant. Several different dosage forms of the herb were used: 200 g of fresh whole herb and 100 g of dried herb in decoctions (in three divided doses per day); granules containing 5 g of dried aqueous extract, three times daily; 0.5 g tablets of dried aqueous extract, 10 tablets each time three times daily; and injection, 2 ml per injection (dose not stated), 2–3 times daily. The herbal preparations were administered for 3–10 days to patients who already had diarrhoea . 387 of the 500 patients with chronic dysentery were reported to have been cured, 13 had not responded within 3 days. All 313 patients with enteritis were reported to have been cured [88].

Treatment of psoriasis

Clinically, 70% ethanol extract of the aerial parts of the plant and an ointment containing 2.5% of the extract were used by 53 patients with psoriasis. After one week of oral administration of the extract (20 drops three times daily) with application of the ointment to the affected areas of the skin once a day, desquamation of the skin was decreased, and a decoloration of the psoriatic plaques was observed. 29 of the patients were clinically recovered, 22 patients were clinically improved and failure of the therapy was recorded in 2 patients [89].

Antimalarial effects

Ethanol extract of the dried whole plant (20 µg/ml) was active against *Plasmodium falciparum* [90].

Contraindications and adverse effects

No health hazards or side effects are known in conjunction with the proper administration of designated therapeutic dosages [67].

The toxicity of *Biden stripartita* was studied experimental in mice. The vegetal product of *Biden stripartita* was obtained by maceration and extraction in alcohol. Acute toxicity of the alcoholic extract of *Biden stripartita* was assessed by median lethal dose LD_{50} calculation, using a limit dose test of up- and- down procedure at a limit dose of 2000mg/k bw after intraperitoneal administration in mice. The animals showed dose-dependent signs of toxicity, ranging from lack of appetite, depression, immobility and respiratory distress to death. Single-dose intraperitoneal LD_{50} value of the alcoholic *Biden stripartita* extract in mice was 4038 mg/kg. No macroscopic changes were seen in the organs of mice that died following extract administration. Histopathological lesions were not found in all examined organs [91].

The biocompatibility properties of alcoholic (200mg/kbw) and (250mg/kbw) aqueous extracts from *Bidens tritartita* were studied by assessing their effects on blood count and serum biochemical tests. The following immune parameters: phagocytic capacity of peripheral neutrophils (NBT test) and serum complement activity were also evaluated. Analysis did not show significant differences on leucocyte formula (GOT, GPT and LDH) or immune parameters (phagocytic capacity of peripheral neutrophils and serum complement activity) between alcoholic and aqueous *B. tripartita* extracts and distilled water, elements suggesting a good in vivo biocompatibility [92].

Dosage

One tablespoon of the infusion (1:20) is given 3-4 times a day for internal use and one glass of an infusion of

10 g of cut herb with 100 g of cooking salt or sea salt per bath for external use [58, 92-94].

CONCLUSION

The paper reviewed *Bidens tritartita*for pharmacological and therapeutic potentials. It is a promising medicinal plant with wide range of pharmacological activities which could be utilized in several medical applications.

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