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Medical Importance of *Glossostemon Bruguieri* – A Review

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Abstract: *Glossostemon bruguieri* contained alkaloids, flavonoids, phenols, steroids, sterols and or triterpenoides, cardiac glycosides, carbohydrate or glycosides, proteins and amino acids. It possessed many pharmacological activities included antimicrobial, hypoglycemic, antiproliferative, diuretic, acaricidal and many other effects. The current review was designed to highlight the chemical constituents and pharmacological effects of *Glossostemon bruguieri.*

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I. INTRODUCTION

Recent reviews revealed that the medicinal plants possessed central nervous[1-4], cardiovascular[4-7], antioxidant[8-10], antidiabetic[11-14], antimicrobial[15-19], antiparasitic [20-22], immunological[23-24]. detoxification, hepato and reno-protective[25-30] and many other pharmacological effects. *Glossostemon bruguieri* contained alkaloids, flavonoids, phenols, steroids, sterols and or triterpenoides, cardiac glycosides, carbohydrate or glycosides, proteins and amino acids. It possessed many pharmacological activities included antimicrobial, hypoglycemic, antiproliferative, diuretic, acaricidal and many other effects. The current review will highlight the chemical constituents and pharmacological effects of *Glossostemon bruguieri.*

Synonyms: *Dombeya arabica* Baker[31]
Taxonomic classification:
Kingdom: Plantae, **Phylum**: Tracheophyta, **Class**: Magnoliopsida, **Order**: Malvales, **Family**: Malvaceae, **Genus**: Glossostemon, **Species**: *Glossostemon bruguieri*[32].
Common names:
Arabic: moghat (Egypt), Erok orab kuzzi (Iraq); **English**: Glossostemon, Calotropis, moghat; **Iran**: Buqnaq; **Turkey**: Arab qosi[33-34].
Distribution:
The plant grows wild in Iran and Iraq, having been introduced to and acclimatized in Egypt since 1932[35].
Description:
It is a shrub that produces long, thick, tapering, dark colored roots between 27 - 40 inches in length and 1 - 3 inches in width[35-36].

Traditional uses:

The root is sold in the bazaars of Egypt and Baghdad in a powdered form and employed by Coptic and Arabian women as a strengthening medicine. Before 1914 it was exported in considerable quantities, chiefly to Egypt, as an aphrodisiac. A decoction of the root is sometimes used at Baghdad as a cough cure(33).

The plant was commonly consumed as a traditional lactagogue in Egypt. It was used in Egyptian folk medicine as a nutritive tonic for the purpose of promoting lactation, increasing body weight, treating gout, and acting as a demulcent[35].

Furthermore, it was given to nursing mothers needing nutritive replenishment and for bone strengthening. Moghat was also used by the Egyptians as an anti-inflammatory, in autoimmune diseases; lupus, rheumatoid arthritis and gout, and to decrease the blood glucose level in diabetes[37].

Powdered roots of *Glossostemon bruguieri* were used in the kingdom of Saudi Arabia, for general well-being in Beni-Sueif, Upper Egypt[38] .

The dried leaves of *Glossostemon bruguieri* were crushed and mixed with wheat flour for the treatment of gastrointestinal disorders in cows, camels, sheeps and goats in the kingdom of Saudi Arabia[39].

Part used medicinally: Roots and leaves[39].

Chemical constituents:

Preliminary phytochemical analysis of *Glossostemon bruguieri* root showed that it contained alkaloids (5.8 ± 0.43% of dry raw weight), flavonoids (1.54 ± 0.05% of dry raw weight), phenols (13.18 ± 2.3% of dry raw weight), steroids (4.5 ± 0.3 pg/g), sterols and or triterpenoides, cardiac glycosides, carbohydrate or glycosides, proteins, amino acids, and calcium (6.2 ± 0.1mg/g root)[40-41]

Non-starch polysaccharides including dietary fiber, pectin and mucilage were the main components of the roots. Chemical analysis of five sun-dried peeled roots of *Glossostemon bruguieri* from different climatic areas revealed that starch was the main component of the roots with 54.5–62.4 g/100 g, protein represented up to 8.3 g/100 g which was low in essential amino acids especially methionine and lysine. The ash content was (≥5 g/100 g) with significant variation among samples. Calcium, magnesium and iron were the major minerals of the roots. The oil is highly unsaturated with about 80% of oleic and linoleic acids, and it was also characterized by high palmitic acid content (13.1–16.6 g/100 g)[42].

The crude protein constituted 19.5% of the seeds, while it made up 4.5% of the peeled dried roots of Glossostemon bruguieri. Glutamic acid, proline, leucine, phenylalanine, histidine and arginine were abundant in the protein of both plant parts; 72 and 83%, respectively. Valine, cysteine, methionine and lysine were detected only in seed protein. Molecular weights of the seed proteins were 50,000, 45,000 and 22,000. Moghat seeds contained 5.0% mucilage, while 15.75% and 29.60% were recorded in roots of one- and two-year-old plants, respectively. GLC investigation showed that both these plant parts contained rhamnose, xylose, mannose and galacturonic acid. Arabinose (1.8%) and glucuronic acid (14.6%) were present only in the seeds, while galactose constituted 33.7 to 34.5% of the root mucilage. Age of the roots was reflected in quantitative differences rather than qualitative ones[43].

The phytochemical analysis of moghat root extract revealed the presence of flavonoid apigenin (17.04%) and the terpenoid squalene (11.32%)[44].

Biflavone moghatin (3″′-hydroxycupressuflavone), 4′-methoxyisoscutellargin, sesamin, chrysophanol, emodin and methoxyemodin (physcion) were isolated from the dried peeled roots of *Glossostemon bruguieri*[45].

Isoscutellarein, 2',4-diHydroxy-4'-methoxychalcone and takakin 8-O-beta-D-glucoside were also isolated from Glossostemon bruguieri roots[46].

Takakin 7-0-glucoside, bucegin 7-0-glucoside, takakin, isosctullarien, its 7-0 -glucoside, takakin 8-0-glucoside. xanthotoxin and esculetin were separated and identified from the aerial parts of *Clossostemon bruguieri*[47].

Oestrone, scopoletin, phytosterols (a mixture of β-sitosterol, stigmasterol and campesterol), α-amyrin, and glucosides of flavone and chalcone, amino acids and fatty acids were also isolated from *Glossostemon bruguieri*[36,48-50].

Both N and K fertilization decreased the mucilage content of the roots, but increased their fat content. The root yield after two years increased by 72% compared with one year old plants. That increment was rather dependent on the root diameter than its elongation. The mucilage content was doubled, while the fat content decreased[51].

The percentages of total lipids in seeds, leaves and roots of the plant were 23.50, 6. 70 and 0. 75%, respectively. Gas chromatographic fractionation revealed the presence of hydrocarbons from C14 to C32, with a common occurrence of hydrocarbons from C16 to C19, C20 to C22 and from C24 to C26 in seeds, leaves and roots with quantitative variations in their percentage. N-Octacosane was the major component in the unsaponifiable matter of the seeds, leaves and roots , while n-tricosane (15 .65%) in the seeds and n-docosane (1.9%) in the leaves were the major components. However, n-tricosane (3.62%), n-unrtiacontane (3.67%), n-dotriacontane (5. 76%), 24-methylene cycloartenol (5.12%) and cholesterol (0.96%) were detected in the unsaponifiable matter of the leaves only. Squalene commonly occurred in the unsaponifiable matter of seeds, leaves and roots , with higher amounts being found in the leaves (10.51 %). Sterols were present in appreciable quantities in the unsaponifiable matter of Moghat leaves[52].

Pharmacological effects:

Antimicrobial effect:

The aqueous extracts of *Glossostemon bruguieri* root possessed no antibacterial effects when it tested in vitro against *A. baumannii*, *E. faecium*, *P. aeruginosa*, *G. morbillorum*, *E. cloacae* and against Standard strains (Gram-positive *S. aureus* ATCC 29213 and Gram-negative *E. coli* ATCC 25922)[34].

The ethanolic extract of Glossostemon bruguieri showed antibacterial and antifungal activity. The zone of inhibition (mm) of the extract (5mg/ml in well of 6mm in diameter) against Gram negative microorganisms: *Enterococcus faecalis* 8, *E. coli* 9, *Moraxella lacunata* 10, *Proteus merabiles* 11, *Serratia*

marcesens 10, *Pseudomonas aerugenosa* 7; against Gram positive microorganisms: *Bacillus subtilis* 12, *Micrococcus luteus* 8, *Sarcina ventricull* 8, *Staphylococcus aureus* 15, and against fung: *Aspergillus flavus* 11, *Aspergillus fumigates* 11 and *Penicillium chrysogenum* 10[41].

Hypoglycemic effect:

The root mucilages of *Glossostemon bruguieri* possessed remarkable hypoglycemic activity, it decreased the blood glucose level in diabetic rats by 54.5% within 15 days[43]

Antiproliferative effect:

The antiproliferative effects of moghat root extract and its apoptotic mechanism were investigated in hepatocellular carcinoma (HCC) cells, HepG2 and Hep3B. MTT assay, morphological changes, apoptosis enzyme linked immunosorbent assay, caspase and apoptotic activation, flow cytometry, and immunoblot analysis were employed. The IC_{50} of moghat root extract for HepG2 (910 ± 6 μg/ml) and for Hep3B (1510 ± 5 μg/ml) induced significant growth-inhibitory effects against HCC cells, with no cytotoxic effect on normal hepatocytes. Moghat root extract treatment induced apoptotic effects to HepG2 cells in a caspase-dependent manner and via upregulating p53/p21 and PCNA. The upregulation of p21 was controlled by p53 expression in HepG2 but not in Hep3B despite upregulation of Bax protein in both cell lines. Interestingly, p21 may be a remarkable switch to G1 arrest in HepG2 cells, but not in Hep3B cells. Furthermore, Fas- and mitochondria-mediated pathways were found to be involved in moghat root extract -induced apoptosis in Hep3B cells[44].

Effect on Juvenile osteopenia:

The efficacy of moghat (*Glossostemon bruguieri*) as an alternative reversal therapy for juvenile osteopenic was studied in rats. Juvenile osteopenia was induced in 15 days old Sprague- Dawley female rats by feeding them free Ca and vitamin D synthetic diet for 21 days. Osteopenic rats were either treated with moghat (0.8 g dried plant tissue/Kg body weight, orally), or with a reference nutritional supplements of calcium chloride (14 mg Ca/Kg) and vitamin D3 (7 IU/ Kg), for extra 21 days. Both untreated and treated groups were compared to a control group that fed a regular pelleted food. The results revealed that osteopenic rats lost normal bone tissue architecture, 30 % of body mass, 54 % of bone mass and finally 93% of bone calcium mass. These changes were associated with an increase in serum phosphate, PTH, alkaline phosphatase, aspartate transaminase activities and creatinine level as compared to the control group. Moghat administration reversed osteopenia by normalizing body and bone masses to the reference ranges, increased the bone calcium mass by 17 fold without any detectable side effects on liver and kidney physiological performance[40].

Acaricidal effect:

Acaricidal activity of the unsaponifiable matter of each organ of *Glossostemon bruguieri* was investigated, the leaves was the most toxic to both adult and egg stages of *Tetranychus urticae*[52].

Nutritional value and the effects on weight gain:

The nutritional content, and biological effects of 3 local weight-gain prepared formulas in the Kingdom of Saudi Arabia were studied. The analysis of the second formula contained (moghat, honey and royal jelly) revealed that it consisted of moisture14.73 %, protein 1.44 %, carbohydrate 81.49 %, fat 2.00, fiber 0.09 , ash 0.2, energy (Kcal/100g) 349.72, minerals contents (mg): calcium 9.89, iron 17.00, vitamins: thiamine HCl (mg) 4.07. This formula provided about 17.5% of daily energy requirement for adult women (2000 Kcal). It gave remarkable body weight gain in rats compared with other formulas[53].

Diuretic effect:

Glossostemon bruguieri powder and its alcoholic extract together with four of the purified compounds (takakin 7-0-glucoside, , isosctullarien, its 7-0 –glucoside and takakin 8-0-glucoside) were shown to increase urine volume but not sodium on albino rats. , being more pronounced and equipotent with that of the standard drug, furosemide[47]

Side effects and toxicity:

The LD_{50} was found to be 2500 mg/ kg body weight for both plant powder and alcoholic extract of *Glossostemon bruguieri* in mice. Oral administration of *Glossostemon bruguieri* powder 500 mg/kg, extract 500 mg/kg and four isolated compounds 100 mg/kg (takakin 7-0 –glucoside, isosctullarein, isosctullarein 7-0-glucoside and takakin 8-0-glucoside) for 15 days in rats didn't induced significant changes in serum level

of AST and ALT. However powder, extract and takakin 7-0 –glucoside induced slight changes in the serum levels of urea and creatinine[47].

Acute and sub-chronic toxicity were preformed in mice. Acute toxicity study gave an indication about the safety of the plant, LD_{50} which was higher than 10 g/Kg. The dose of 200, 500 and 1000 mg/ml of aqueous moghat suspension had no hepato- and/ or nephro-toxicity. The efficacy of moghat (*Glossostemon bruguieri*) as an alternative reversal therapy for juvenile osteopenic was studied in rats. Rats were treated with 0.8 g dried plant /Kg body weight, orally for 21 days without any detectable side effects on liver and kidney physiological performance[40].

II. CONCLUSION

The current review discussed the chemical constituents and pharmacological effects of *Glossostemon bruguieri* to encourage its uses in medical practice as a result of efficacy and safety.

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