A review of *Solennostemma argel*: Phytochemical, pharmacological activities and agricultural applications

Farah Khameis Farag Teia

1 Agro-technology Department, Medicinal and Aromatic Plants and Traditional Medicine Research Institute (MAPTMRI), National Centre for Research (NCR), Khartoum - Sudan

ABSTRACT

The present review aims to outline the research on biological activities and phytochemical composition of *Solennostemma argel* Del. Hayenne reported in literature from 1980 to late 2017. The plant is indigenous to Africa, used in traditional medicine worldwide, particularly in African countries, Saudi Arabia, and Palestine. Substantial studies indicate that *S. argel* contains a variety of compounds and provides diverse bioactivities with no toxicity. This review paper focuses mainly on the herbal uses, phytochemicals, pharmacological activities, and agricultural applications, further study should be given to identify and evaluate the potential compounds of Argel plant that have biological activities in medicine and agriculture, which should be useful for further advance study and application.

Keywords: Argel plant, folk medicine, biological activity, Sudan.

INTRODUCTION

The plant *Solennostemma argel* Del. Hayenne (Asclepiadaceae), is a desert plant indigenous to Africa, used in traditional medicine worldwide, particularly in African countries (Sudan, Libya, Chad, Egypt and Algeria), Saudi Arabia and Palestine [1, 2, 3, 4]. This plant is regarded as the richest source in Sudan and locally called Hargel, it is indigenous in the northern region [5], widely spread in the places between Dongola and Barber, particularly around Abu Hamad area [1], Sudanese are used Hargel plant in traditional medicine as anti-inflammatory, anti-spasmodic, anti-rheumatic agent, carminative and as an anti-diabetic [4, 6, 7]. The plant can used as anti-nutrition factors [9] and anticancer [10].

Botanical description

The plant is an erect herbaceous perennial plant that grows up to 60-100 cm tall, with several vigorous stems. The leaves are, oval, leathery and covered with fine hairs. It has numerous flowers with white petals, and a strong smell, flowering period extends from March to June. The fruits are box shape about 5 cm. long and 1.5-2 cm- wide, green with violet lines; they contain pubescent seeds [11].

Phytochemicals

Phytochemical of *S. argel* had been studied by many researchers [6, 12, 13, 14]. It has been studied from different parts of *S. argel* (leaves, stems, and flowers) and provided numerous ingredients and crystalline compounds [8, 15]. Previous study conducted by [11] reported and classified some chemical constituents of *S. argel* are including acylated phenolic glycosides, namely argelin and argelosid, choline, flavonoids, monoterpenes, pregane glucoside, sitosterol, and a triterpenoid saponin. Hamed, (2001) [13] described two of stemmosides (A, and B) as pregnane ester glycosides, and stemmin C as polyhydroxy pregnane of Argel plant.

Also, leaf extracts contain; quercetin, rutin, flavanones, and alkaloids, flavonoids, and kaempferol [16, 17]. Murwan et al., (2010) [9] reported that leaves of *S. argel* are characterized by having (64.8%) carbohydrates, about (15 %) was protein, and he found that crude oil, moisture content, and ash (1.6%, 4.4% and 7.7% respectively), they estimated that minerals content, whereat, they found high potassium about 0.54%, calcium, magnesium, and sodium (0.06%, 0.03%, and 0.01% respectively), while manganese, ferrous, lead, and copper were estimated as low percentages (0.001%, 0.002%, 0.002%, 0.001%, and 0.0001% respectively). And [9] fractionated the protein of argel leaves to different compounds including: albumin, non-nitrogenous protein, prolamine, globulins, and glutelin. In addition leaves of argel also contained anti-nutrition factors (phytic acid, and tannin) [9].

*Corresponding author:
Farah Khameis Farag Teia
Agro-technology Department, Medicinal and Aromatic Plants and Traditional Medicine Research Institute (MAPTMRI), National Centre for Research (NCR), Khartoum - Sudan
Email: farfor157[at]gmail.com
Herbal Medicine

Historically, the first form of healthcare known to human is herbal medicine, it was the result of many observations of mankind and wild animals. Argel leaves are used to treat many diseases including kidney, liver, stomach diseases, and some allergies [18, 19, 20].

Infusion of leaves is used to treat gastrointestinal cramps, as laxative [21], stomach ache; anti-colic, urinary tract infections, cold and anti-syphilitic for prolonged period time between 40- 80 days [1, 22, 23] and as an anti-inflammatory [24].

Also, argel leaves are used to treat measles as incense, sometimes crushed leaves of argel are used as remedy to treat sciatica, neuralgia, and for supporting wounds and bronchitis [18, 22].

Taj Al- Deen and Al-Naqeb, (2014) [23] reported that, in Yemen argel leaves are used as herbal medicine for prevention of diabetes and the leaves are consumed as tea, and his result study was carried out biological investigation on argel leaves as a hypoglycemic agent.

The whole of argel plant is used as incense to treat many diseases including: diabetes mellitus, hypercholesterolemia, cough, cold, jaundice and measles [11].

Pharmaceuticals

Osman et al., 2014 [25] examined the effect of crude leaves extract of Argel plant on serum biochemical constituents and electrolytes in albino rats and to discuss their values in relation to kidneys and liver functions, the findings of this study suggested that the dose 600 mg of extract /Kg BW was more likely to have adverse effect on liver and kidneys of albino rats.

Anti-inflammatory

The anti-inflammatory activity was evaluated from the leaves extracts of S. argel using the carrageenan-induced Wister rats edema model, Argel extract exhibited an inhibition of inflammation, at a dose of 100 mg/kg body weight after 3hr (22%) of carrageenan administration [24].

In the same line, Innocenti et al., (2010) [27] investigated the anti-inflammatory activity of Argel leaves by the Croton oil ear test in mice.

Antimicrobial

The plant was reported to have antimicrobial properties [12, 14, 25, 28], the antifungal and antibacterial properties of the aqueous extracts of Solenostemma argel against Aspergillus niger, Penicillium italicum, Escherichia coli and Salmonella typhi was investigated by Sulieman et al. (2009).

Anticancer

The aqueous extract of Argel leaves was showed activity against tumor tissue of Ehrlich Carcinoma (EC), hence, significantly reduce the risk of tumor volume and represent wide and high zones of apoptotic tumor cells [10].

Analgesic activity

Mudawi et al., (2015) [29] studied the analgesic effects of leaves extract of Solenostemma argel by using hot plate and acetic acid induced writhing technique respectively, tested in mice.

Antioxidant

Taj Elddeen et al. (2014) [23] studied the antioxidant activity (DPPH assays) of Solenostemma argel (leaves and stems). He reported that all extract exhibited high antiradical activity towards DPPH radical. The scavenging activity of the pure antioxidant standard, ascorbic acid was 46% at lower concentration of 250μg/ml. The radical scavenging activity was increased by concentration to 63 at 500μg/ml and 77% and at 1000μg/ml. But at lower concentration [250 μg/ml] after 30 minutes, the reaction Argel extract was scavenged 32%, of the total radicals in the reaction system. Increased at higher concentration (1000 μg/ml) to 57 and 84% of the total radicals respectively.

Toxicity

A numbers of studies showed that Argel extracts have antioxidant and exhibited hypoglycemic effect without non-toxic effect, so, researchers suggested that Argel extract can be used in health food, a nutritional supplement and management of patho-oxidative disorders and diabetes [17, 30, 31].

AGRICULTURAL APPLICATION

Insecticidal

Because of eco-friendly to the environment and safety to the human health, botanical insecticides considered as safe alternatives compared to chemical insecticides [31]. Idris et al., (2011) [38] report that, the farmers in Kassala State, Sudan are used argel shoots as pesticide to control pests on tomatoes (aphids, and white flies), and on okra (Egyptian bull worm).

Several studies are explored the potential of argel plant application as botanical insecticide to control; Asterolicanium phoenicis, aphids [18, 31], mosquito species, the causative agent of malaria in Sudan [33, 34, 35, 36], the adults of the Saw-toothed Grain Beetle, Oryzaephilus surinamensis [37], and Henosepilachna elaterii the melon ladybird beetle [28].

Nematicidal

Extract of Argel leaves represent high mortality rates against second-stage juveniles of Meloidogyne incognita after 24, 48 and 72 h using a normal binocular microscope [34].

Soil application

According to, soil additives of dry leaves of argel (either as growth promoting ingredients or botanical pesticide) enhanced the flowering and yield palm tree (a dry date cultivar) in the Northern State, Sudan [18, 33].

CONCLUSION

Collectively, further study should be given to evaluate the potential compounds of Argel plant that have biological activities in medicine and agriculture, it is consider that to find naturally compounds to replace synthetic which are being restricted and affect human health and Environment.

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