

Review of Ethnomedicinal Plant *Fagonia*

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ABSTRACT

Plants are the most important source of medicine to the mankind. Ancient and traditional verbal as well as documented sources are treasure of potential medicinal properties of plants. In the new era of science and technology there is increasing need to validate the claims of traditional knowledge database for safe, easily available, cheap, side-effect free healthcare provisions. Some species from the genus *Fagonia* are supposed to possess important medicinal properties. This article provides a generalized review of major published research concerning *Fagonia* species carried worldwide in recent past in areas of its systematics, phytochemistry and bioactivity. The aim of authors of this review article is to help researchers working or planning to work in the area of ethnomedicine, drug discovery and phytochemistry by providing information of the works carried on *Fagonia* species in a summarized format. However details of morphological characters and microscopic parameters of the *Fagonia* species are not scope of this review article.

Keywords: *Fagonia*, traditional medicine, therapeutics, validation

INTRODUCTION

Use of medicinal plants or herbs has a long history throughout the world and herbal preparations including herbal extracts can be found in the pharmacopoeias of numerous countries. In recent years there has been a renaissance of interest in natural or herbal remedies worldwide, partly because of the realization that modern medicine is not capable of providing a “cure-all” solution against human

diseases and that the presence of unwanted side-effects is almost unavoidable[22]. Genus *Fagonia* (family *zygophyllaceae*) with variety of its species are also claimed to possess medicinal properties which are being studied by investigators worldwide [5,36,40]. Although there are about 35 different species comprise genus *Fagonia*, the medicinal claims are mostly restricted to a few species only

viz. arabica[5,18,30,36], *indica*[39] and *cretica* [32,33]. Validation of therapeutic claims of other species [34] (if any) is found less often.

1. Historical accounts:

The oldest documented reference of using *Fagonia* herb comes not from medicinal expert but seventh century Arabic poet Amro Ibn Al Ahmer. The octogenarian poet composed the poem during his protracted terminal illness of ascites. This ascites sufferer states that he drinks Al Shokaa (*Fagonia* in Arabic) and keeps chewing it under his tongue for recovery [1]. Similarly Ayurveda also mentioned its use in various forms well before millennia.[30, 36].

In modern age, during 1753, Linnaeus erected the genus *Fagonia* in Species *Plantarum Linnaeus* and recognized three species initially. Currently 35 species are grouped under genus *Fagonia*. The genus name *Fagonia* was given in honor of the Professor of Botany and Director of the Jardin de Roi in Paris, G_C. Fagon. [11] Remarkable work in the field of phylogeny and taxonomy of genus *Fagonia* has been carried by Beier and co-workers beginning with morphological characters and encompassing molecular details. [12,13] which was also extended to understand biogeography of the plants in detail using parsimony and Bayesian model averaging[14]

2. Occurrence

The genus *Fagonia* is confined to warm and arid areas of all continents except Australia. The genus consists of shrubs, shrublets or herbs with some of its peculiar characters. The genus *Fagonia* is a member of family *Zygophyllaceae*. [11]. Species grow wild and perennial with woody base.

Height of the plant varies from 20-55 cm and color varies from dark to pale green depending on species. The species from *Fagonia* exhibit some morphological differences. [8]

3. Traditional claims of medicinal properties associated with *Fagonia*

Long and interesting lists of diseases and disorders are given which are supposed to be cured by *Fagonia*. The suggested mode of treatment is internal as well as external depending upon type of disease and disorder [21] The list includes *viz.* sore mouth and small pox [41] hematological, neurological, endocrinological, dermatological and inflammatory disorders, small pox and endothermic reactions in the body [9, 30] jaundice, fever abscesses [21] blood purification, fever, cold, cough [25] astringent, febrifuge, small pox, fever, thirst, vomiting, dysentery, asthma, urinary discharges, liver trouble, typhoid, toothache, stomach troubles and skin diseases, anti-tumor [6].

4. Validation studies of the traditional claims and investigations of new uses:

Number of studies has been carried out to validate the ethnomedicinal claims of *Fagonia* as well as potential new uses of its constituents. Some of them are enlisted below in tabular form. Table I provides list of experiments conducted for investigating the anti-oxidant and/or free radical scavenging activity associated with plant extracts. Table II enlists blood and haematology related studies. Table III and IV cover the investigations for diabetic claims and activity as anti-cancer/anti-tumor agent respectively. Other non-specific studies are given in Table V as well as few are described at the end.

Table I: Anti-oxidant activity

Sr. No.	Species	Preparation	Organ/System/Model	Result/Conclusion	Reference
1	<i>F. arabica</i>	Total extract	Ischemia induced oxidative stress in rat PC12 cells – in vitro	Concentration dependent anti-oxidant activity / free radical scavenging at 1000 µg/ml	36
2	<i>F. arabica</i> and <i>F. bruguieri</i>	Aqueous and methanolic	Improved ABTS method for assaying antioxidant potency	<i>F. arabica</i> better than <i>F. bruguieri</i> . Aqueous extract is more potent than methanolic	40

3	<i>F. schweinfurthii</i>	Ethanollic	Antioxidant against CCl ₄ mediated oxidative stress in HepG2 cell line	<i>F. schweinfurthii</i> can be a good liver tonic	29
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Table II : Blood and hematology

Sr. No.	Species	Preparation	Organ/System/Model	Result/Conclusion	Reference
1	<i>F. arabica</i>	Aqueous extracts	Blood clot lysis in vitro	<i>Fagoniaarabica</i> can be incorporated as a thrombolytic agent for the improvement of patients suffering from atherothrombotic diseases	30
2	<i>F. arabica</i>	combinations of fish extract from <i>Heteropneutisfossilis</i> along with plant extract of <i>Fagoniaarabica</i>	Human blood in vitro	Atherothrombotic diseases can be treated by combinations of fish extract from <i>Heteropneutisfossilis</i> along with plant extract	18
3	<i>F. cretica</i>	Different constituents	Male Rabbits	Leukocyte count decreased during experimental duration with duration specific trends	32
4	<i>F. arabica</i>	50ug/ml	Blood co-agulation and fibrinolysis in viro	Effective similar to streptokinase	17

Table III: Diabetes

Sr. No.	Species	Preparation	Organ/System/Model	Result/Conclusion	Reference
1	<i>F. cretica</i>	Crude extract	<i>In vitro</i>	Extract contains significant DPP-4 inhibitory activity	33
2	<i>F. arabica</i>	Methanolic extract	<i>In vitro</i>	Anti-inhibitory for hormone sensitive lipases	15
3	<i>F. arabica</i>	Methanol extract	Pancreatic lipase inhibitory activity	Inhibits pancreatic lipase activity in a dose dependent manner	16

Table IV: Anti-cancer and anti-tumor

Sr. No.	Species	Preparation	Organ/System	Result/Conclusion	Reference
1	<i>F. indica</i>	Aqueous infusion	Experimentally induced tumors in male and female rats	Tumorostatic effect found which is more significant in females than in males	39
2	<i>F. cretica</i>	Extract	against tumor induction by three strains of <i>Agrobacterium tumefaciens</i>		6
3	<i>F. cretica</i>	Extract	Breast cancer cell	Arrest cell cycle, induce apoptosis	26

Table V: Other validations

Sr. No.	Species	Preparation	Organ/System	Result/Conclusion	Reference
1	<i>F. cretica</i>	Alcoholic extract of aerial parts	Estrous cycle and implantation	Omission of heat phase and 100% anti-implantation activity	3
2	<i>F. schweinfurthii</i>	Alcoholic / gel	carrageenan induced rats paw edema and excision wound	Significantly healing activity	34
3	<i>F. arabica</i>	Whole plant decoction	Urease inhibitory activity	Potent anti H-pylori	9
4	<i>F. arabica</i>	Whole plant in dried form	Traditionally used by people of Gujarat, India	Therepeutic diuretic	24
5	<i>F. cretica</i>	Powder	Endocrinological parameters in rabbit	Influenced prolactin, thyrotropin, thyroxine and cortisol levels	10
6	<i>F. schweinfurthii</i>	Ethanollic	CCl ₄ treated rats	Hepatoprotective	29

5. Anti-microbial and other studies:

Apart from the above lists many other studies have been carried on *Fagonia* species to test its potential to help managing diseases as well as environment in an eco-friendly manner.

Aqueous and ethanol extracts of *Fagonia arabica* were found as repellent for aphids. [37] Different extracts from aerial parts of *Fagonia arabica* exhibited varying degree of molluscicidal activity when studied against schistosomiasis vector snail. [20] Acetone extracts of *Fagonia arabica* at a concentration of 8 µg/mL of MIC were found effective against *Helicobacter pylori* related diseases. [42]. In another study urease inhibitory activity of *Fagonia arabica* whole plant extract showed potent anti-*H. pylori* potential in form of urease inhibitory activity. *Fagonia arabica* aqueous extract also exhibited antibacterial activity when tested against various fish pathogens. It shows its use as an alternative for fish antibiotics. [4] The leaves were studied for anti-microbial against *Micrococcus luteus* (ATCC 9341) and found dose dependent inhibition when tested by streaking method. [41]. Hexane, dichloromethane, ethyl acetate, and ethanol extracts of plant *Fagonia arabica* were tested for *in vitro* antimicrobial activity. In these studies hexane extract showed marginal antimicrobial activity against *E. Coli*, *S. epidermidis*, *S. aureus*, while dichloromethane, ethyl acetate and ethanol extract exhibited inhibition zones against *B. subtilis*. Based on these results it is suggested that *F. arabica* can be used to treat bacterial diseases such as gastrointestinal infection, diarrhea, respiratory and skin diseases. [38]

6. Phytochemistry

One of the earliest work, by 1977 reported 8-*O*-methylherbacetin – 3- rutinoside as the major component of *Fagonia arabica*. [35] In one important studies related to the phytochemistry of constituents of *Fagonia*

species (Al-Wakeelet *al*) reported for the first time that Kaempferol and isorhamnetin 3-rutinosides were the major flavonoids of *F. mollis*, while *F. tristis* contained, in addition, 8-*O*-methylherbacetin. One important finding of the study was that the flavonoid patterns discovered were somewhat correlated with the geographic distribution of species *Fagonia mollis* and *F. tristis* [7] Flavonoids of *Fagonia* species are also studied by El-Negoumy *et al* where the researchers investigated flavonoids of *Fagonia taekholmiana* and four other varieties of *Fagonia arabica* collected from Egypt, and led to identification of six different flavonoids. Amongst which isorhamnetin 3-glucoside and 3-rutinoside were accountably present while herbacetin 8-rutinoside showed strong presence as well as herbacetin 8-methyl ether-3-rutinoside showed a major considerable amount, however 3,7-diglucoside and 3-rutinoside-7-glucoside were present with merely traceable amount. [19] Flavonoids of *Fagonia bruguieri* are studied in detail by Maksoud and El-Hadidi (1987). [27] Saponins are also important constituent of *Fagonia* plant. Saponins from *Fagonia arabica* are studied by Miyase *et al* [28]. Saponins from *Fagonia cretica* are studied by Abdel Khalik *et al* [2] A compositional and structural investigation study reported some common and rarely occurring terpenes as well as two new sulfated triterpenes and four new sulfated triterpene glycosides from aerial parts of *Fagonia arabica* [31]

CONCLUSION

As evident from the review many researchers are investigating different aspects of plants from genus *Fagonia*. However number of studies carried and the number of claimed therapeutic uses are still disproportionate. There is tremendous scope to work with different parts, fractions and constituents of

Fagonia species and elucidating the underlying mechanisms. More research and investigations are needed to understand the genus to its fullest for the betterment of mankind.

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