

FAGONIA: A POTENTIAL MEDICINAL DESERT PLANT

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ABSTRACT

Desert plants are unique adaptation from environmental conditions. *Fagonia* is a genus of plant in the family *zygophyllaceae* with about 20 species around Mediterranean to India, S. Africa, California, Chili. The local name of fagonia is dhamasa. They are traditionally well known for the treatment of hemorrhoids, inflammation, sores, leprosy, open wounds and fever in the form of internal and external conventional formulation. When the powder that is made up of the whole plant of *F. schweinfurthii* is dusted on boils and skin eruptions, it causes healing, when the whole plant is boiled in water, its bath is useful for allergies and other skin diseases and decoction is given orally as blood purifier. The other species like *Fagonia bruguieri* its aqueous extract is claimed for anti-allergy. Methanolic extract of *Fagonia cretica* is claimed for good antimicrobial potential and it exhibited strong free radical scavenging properties against reactive oxygen and nitrogen species. The other effects of *Fagonia* species include anti-inflammatory, analgesic, antipyretic and thrombolytic activities are observed. Many chemical constituent's, such as triterpenoids, saponins, flavonoid glycosides, etc., have already been reported in different *Fagonia* spp.

Keywords: *Fagonia*, Dhamasa, Skin diseases

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INTRODUCTION

Plants and herbs have provided natural remedies for human ailments from time immortal. As knowledge progressed, man selected different herbs for cure of different diseases and ailments. The World Health Organization (WHO) estimated that about 80% of the world's population relies on traditional medicines for their primary health care. Most of the plants, which are used for various ailments, have not been properly investigated. About 30% of the pharmaceuticals are prepared from plants worldwide [1].

Fagonia is a small, spiny, erect, under shrubs, more and less grandular; branchess slander, terete, triate, glabrous. Leaves opposite, 1-3 foliate; petioles very variable in length, from 3 - 30 mm long, deeply striate, very slender; stipules 2 pairs of sharp slender thorns, sometimes exceeding 12 mm in length; leaflets linear, acute, sessile or with very short petiolules. It is branching herbs woody at the base, erect or prostrate [2]. Number of species like *Fagonia cretica*, *F. arabica*, *F. bruguieri*, *F. mysorensis*, *F. indica*, *F. schweinfurthii*, *F. laevis*, *F. longispina* etc. have been identified. Traditionally it is used in Sind and Afganistan as a popular remedy for fever among the hill people. The plant is given as a tonic and febrifuge, and in the Peshawar Valley it is given to children as a prophylactic against small- pox. The leaves and twings are supposed to possess cooling properties.

In the Ormara hills the plant is pounded and bound upon the swellings of the neck and for scrofula. At Saruna in Jhalawan it is pounded in water and strained; the liquid is rubbed all over the bodies of children when they get fever. In Kharan an infusion made with hot water is used as a bath in cases of fever. The plant is considered to cure for itch in the Las Bela State: and in the Levy tracts it is for that purpose pounded, mixed with milk, kept for three days and then rubbed all over the body [3].

Fagonia species were extensively studied by many workers regarding their medicinal uses, since these plants were antitumor, antioxidant, analgesic, astringent, febrifuge and prophylactic against small-pox agents. Species of *Fagonia* were also used for the treatment of cancer in the indigenous system, fever, asthma, urinary discharges, toothache, stomach troubles and kidney diseases. Species of *Fagonia* have been found to contain saponins , alkaloids , terpenoids , sterols , flavonoids , proteins and amino acids, coumarins , trace elements [4].

Pharmacological Activity of *Fagonia* Plant

1. Anti-inflammatory and wound healing property

Saleh I. Alqasoumi *et al.* conducted a study to investigate the anti-inflammatory and wound healing affect of 90% alcoholic extract of *Fagonia schweinfurthii* formulated gel on carrageenan induced rats paw edema and excision wound model, respectively. The effects were compared with the anti-inflammatory diclofenac sodium ointment (Diclomax®) and the wound healing povidone-iodine (Betadine®) drugs. The herbal gels and diclofenac sodium ointment were topically applied (0.5 g) to the planter surface of the left hind paw and anti-inflammatory effect was observed within 3 h. The wound healing effect was investigated by application of 0.5 g/wound of the *F. schweinfurthii* gel and Betadine® once daily for 19 days to the excision wound of albino rats and was observed at 4 days intervals. It was observed that gel formulations have progressive anti-inflammatory effect and

accelerate the wound closer time. This study suggests that *F. schweinfurthii* plant extract gel formulation could be developed as a therapeutic agent for anti-inflammatory and wound healing effects [4].

2. Androgenic actively

Abirami V. *et al.* studied on *Fagonia cretica*. They were investigated the effect of alcoholic extract of the arial parts of *F. cretica* on estrous cycle and implantation in female albino rats. In the study they were found that *Fagonia critica* induces distortion in the regularity of the estrous cycle of the rats in which there is random omission of the heat period (estrous phase). Its disappearance index +53.33 which accounts for the reduction of the desire of the females to mate with makes. When administered in the dose of 250 mg/kg p.o it significantly acted as an antiimplantation agent. The drug suspension has significant androgenic actively as the weights of both seminal vesicles and ventral prostate increased in comparison to the control value. It does not seem to possess any antiandrogenic activity as the values obtained by treatment with testosterone propionate were no significantly altered when the combination of the two was given [5].

4. Anti-allergic property

Al- Tahya *et al.* investigated the anti-allergic property of *Fagonia bruguieri*. In this the whole plant *Fagonia bruguieri* DC. was extracted with boiling water and freeze-dried. The LD50 values of the dried extract were found 11.5 and 10.75 g/kg i.p. in mice and rats, respectively. Treatment of albino guinea-pigs with the extract in doses of 200 mg/kg (i.v.) or orally antagonized histamine (20 µg/kg i.v.) and capsaicin (100 µg/kg i.v.) induced bronchoconstriction without affecting that induced with ACh and 5-HT. The percentage antagonisms were 72 ± 0.9 and $65 \pm 4\%$ against histamine and capsaicin, respectively ($P < 0.01$, $N = 10$). Exposure of conscious guinea-pigs to histamine aqueous aerosols (10 mg/ml) induced initial gaspings and reversible loss of consciousness within 5 minutes. Treatment of the guinea-pigs with the extract in doses of 1.25 g/kg (i.p.) for 20 minutes or orally for 2 hours protected significantly the animals against histamine-induced gasps and loss of consciousness ($P < 0.01$, $N = 11$) [6].

3. Neuroprotective activity

Avinash K Rawal *et al.* reported the neuroprotective activity of three herbs *Rubia cordifolia* (RC), *Fagonia cretica linn* (FC) and *Tinospora cordifolia* (TC). In study Hippocampal Slices were subjected to OGD (oxygen glucose deprivation) and divided into 3 groups: control, OGD and OGD + drug treated. Cytosolic Cu-Zn superoxide dismutase (Cu-Zn SOD), reduced glutathione (GSH), glutathione peroxidase (GPx), nitric oxide (NO) was measured as nitrite (NO₂) in the supernatant and protein assays were performed in the respective groups at various time intervals. EPR was used to establish the antioxidant effect of RC, FC and TC with respect to superoxide anion (O₂-), hydroxyl radicals (.OH), nitric oxide (NO) radical and peroxyxynitrite anion (ONOO) generated from pyrogallol, menadione, DETA-NO and Sin-1 respectively. RT-PCR was performed for the three groups for GCLC, iNOS, Cu-Zn SOD and GAPDH gene expression. In result they were found that all the three herbs were effective in elevating the GSH levels, expression of the gammaglutamylcysteine ligase and

Cu-Zn SOD genes. The herbs also exhibited strong free radical scavenging properties against reactive oxygen and nitrogen species as studied by electron paramagnetic resonance spectroscopy. In addition all the three herbs significantly diminished the expression of iNOS gene after 48 hours which plays a major role in neuronal injury during hypoxia/ischemia [7].

5. Endocrinological property

Asif *et al.* investigated the effects of powdered *Fagonia cretica* plant and its two major triterpenoid saponins (saponin-I and saponin-II) on various blood endocrinological parameters. Prolactin namely, serum prolactin, serum thyrotropin, serum thyroxine and serum cortisol of normal male rabbits were investigated. Two major triterpenoid compounds, saponin-I and saponin-II, were isolated from its ethanolic extract by repeated chromatography on silica gel, sephadex LH-20 and on biogel P-2. These compounds were identified after comparing their values of ¹H NMR and ¹³C NMR chemical shifts with previously reported values of similar compounds. Radio-immunological assay was used for the estimation of blood hormones of crude drug and saponin-treated animals using radioactive I¹²⁵. The radioactivity of the standard and the unknown specimen in each case was then measured on NE-1612 gamma scintillation counter for 90 seconds. Both the saponins in 30 mg doses had significant decrease in prolactin and in the serum TSH levels as compared with crude drug treatment and control groups. The thyroxine level was also significantly reduced by saponin-II in a 30 mg dose while the crude drug and saponin-I had non-significant effects on thyroxine after 16 days. A significant increase in serum cortisol occurred with the crude drug in a 1g dose and with both saponins in 30 mg doses. Maximum increase in the serum cortisol occurred with saponin-II after 16 days [8].

6. Antimicrobial activity

Anjum *et al.* worked on *Fagonia cretica* and investigate the antimicrobial activity of its constituents. In the study eleven compounds have been isolated from methanolic extract of whole plant of *F. cretica*. The methanolic extract was fractionated into n-hexane, EtOAc, n-BuOH, and H₂O soluble fractions. The repeated silica gel column chromatography and preparative TLC of n-hexane and EtOAc soluble fractions resulted in eleven compounds including linoleic acid, β-sitosterol-3-O-β-D-(6-hexadecanoyl)-glucopyranoside, methyltriacontanoate, teraxerol, β amyryl acetate, oleanolic acid, octacosanoic acid, tetraerone, arjulonic acid, and 23-hydroxy ursolic acid. The isolated compounds were tested for their antimicrobial activity. The compounds showed significant antimicrobial activity against *Bacillus subtilis*, *Shigella flexneri*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Trichophyton longifusus*, *Candida albicans*, *Aspergillus flavus* and *Candida glabrata* [9].

7. Analgesic and Antimicrobial activity

Sharma S *et al.* evaluate the anti-microbial and analgesic activity of the ethanol and aqueous extract of *Fagonia indica* leaves extracts. Antimicrobial study of ethanol extract of *Fagonia indica* leaves extracts (25, 50 and 100 mg/ml) were tested against gram negative and gram positive bacterial strains by observing zone of inhibition. The bacteria used in this study were *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 29213), *Pseudomonas aeruginosa* (ATCC 27853) and *Bacillus cereus* (ATCC 6633). Analgesic activity of various solvent extracts (200 and 400 mg/kg) of *Fagonia indica*

was studied by tail flick method in rats. The results were analyzed statistically by regression method. The result was shown that the ethanol extract showed significant inhibitory effect against all bacterial strains but it showed maximum inhibitory effect against *Bacillus cereus* and minimum inhibitory effect against *Pseudomonas aeruginosa*. In the analgesic activity both extracts (ethanol and water) were shown significant ($p < 0.05$) analgesic activity [10].

8. Cytotoxic and antitumor activity

Ahsan Hussain, *et al.* observed the cytotoxic and antitumor activity of *Fagonia cretica*. In the study, this information was analyzed at laboratory level by performing cytotoxic, antitumor (potato disc) and DNA damage assay. Significant cytotoxic activity was found against brine shrimps at LD50 118.89 ppm, while antitumor assay showed that the extract inhibited tumor induction on potato discs. Significant antitumor activity was found against all the tumor-inducing *Agrobacterium* strains tested (At6, At10 and At77), with maximum tumor inhibition (77.04%) against At10. However, the extract did not show any lethal activity against *Agrobacterium tumefaciens* strains, and furthermore, no DNA damaging activity was observed. The overall results indicate a strong anti-cancerous potential of this plant [11].

Matt Lam et al demonstrate that an aqueous extract of *Fagonia cretica* can induce cell cycle arrest and apoptosis via p53-dependent and independent mechanisms, with activation of the DNA damage response. They also show that FOXO_{3a} is required for activity in the absence of p53. Their findings indicate that *Fagonia cretica* aqueous extract contains potential anti-cancer agents acting either singly or in combination against breast cancer cell proliferation via DNA damage-induced FOXO_{3a} and p53 expression [12].

Soomro AL et al investigated the effect of *Fagonia indica* on experimentally produced tumours in rats. They were found that the survival of the rats administered *Fagonia* extract was significantly longer than the control group. In the treated group the survival of female rats was 83.2+12.67 days (range 55-118 days), while that of the treated male rats was 59.4+ 10.07 days (range 39-98). In the untreated female rats the survival was 38.9+4.16 days (range 21-57 days) while the non-treated males survived for 17.0+2.55 days (range 10-27 days). The difference in survival between the treated and untreated rats was statistically significant ($P < 0.01$) with the females significant ($P < 0.01$) in both the male and female rats. In treated group the difference between the survival of female and male rats surviving longer. In the non-treated group no such difference was found between the survival of male and female rats ($P > 0.1$). This initial experiment has shown that an aqueous infusion of *Fagonia indica* has a tumourostatic effect which is more significant in the females [13].

CONCLUSION

According to traditional knowledge and investigations of various researchers it is concluded that *Fagonia* plant has medicinal potential and can be used for various pharmacological action.

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