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An Overview on Properties, Therapeutic Efficacy of the Indian Magical Herb- "SANJEEVANI"

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ABSTRACT

The depiction of Sanjeevani booti in the great Indian epic "Ramayana" as a "life saving herb" which could save the life of Lakshman led to its exploration enthusiasm among the researchers. Its exploration directed to the discovery of an herb having characteristics similar with this magical herb "Sanjeevani booti". This herb scientifically known as *Selaginella bryopeteris i*s found in the Arawali Mountain of the Himalayan which ranges from east to west in India retaining the ability to resurrect life. Its ability to treat wounds and bleeding during menstruation, uterine disorders, and other internal injuries as well as its activity as antioxidants, anti-inflammatory, anti-cancer, anti-allergic, antimicrobial, antifungal, antibacterial, antiviral etc due to the presence of secondary metabolites such as alkaloids, phenol and terpenoids etc increases its applicability as a tonic to improve fitness and hence to expand life span. Recent investigations explore another herb in the mountain ranges of Himalayas, which is scientifically known as "Rhodiola" possessing properties similar with Sanjeevani. Scientists called it as "Modern Sanjeevani". Thus the present review article encompasses the general characteristics, habitat, therapeutic properties of *Selaginella bryopeteris* and the recent findings on Rhodiola.

Keywords: Sanjeevani, Therapeutic properties, Rhodiola, Curing Jaundice.

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INTRODUCTION

SANJEEVANI (literally meaning something that offers life; jeeva = life) which in botanical language known as *Selaginella bryopteris* (Figure 1), is known for its remarkable renaissance capabilities[1].In Indian mythology, it is known to be the most mysterious and most required herb. Its alleged potentiality for 'resurrecting' life makes it a controversial Miracle herb. It is believed that medicines prepared from this herb can even revive a dead person also, as it is depicted in great Hindu epic Ramayana. In this world famous epic of Hindi poet *Tulsidas,* the wonder herb known as Sanjeevani booti (Life giving herb), had a popular belief that it gave life to the dying Laxmana, the younger brother of Lord Shree Rama. This herb was mentioned in the Ramayana when, during[2] the battle with Ravana (the King of Demons), Lakshman was wounded and was nearly killed by Ravana's son Meghnaad. Hanuman was called upon to fetch this herb from the Dronagiri mountain in the Himalayas (Currently in Uttarakhand State of India)[3]. Upon reaching Mount Sumeru, Hanuman was unable to identify the herb and decided to lift the entire mountain and brought it to the battle-field. It is also mentioned in Ramayana, that the Sanjeevani booti has the unique property of bioluminescence, which helps in its easy identification. It is known to be a magical herb having tremendous medicinal properties to cure every known and unknown problem[4].

Figure 1: *Selaginella bryopteris* herb

Classification[5]

Selaginella bryopteris - a fern plant.

Kingdom: Planatae

Division: Lycopodiophyta

Class: Lycopsida

Order: Selaginallales

Family: Selaginellaceae

Genus: *Selaginella*

Species: *bryopteris*

Belonging to the same Family- Selaginellaceae, another species of the genus- *Selaginella* is available with properties similar to *Selaginella bryopteris.* This herb is known as *Selaginella lepidophylla.* Commonly, it is also known as false rose of Jericho, rose of Jericho, resurrection plant, resurrection moss, dinosaur plant, siempre viva, stone flower, and doradilla. Also known as "resurrection plant" due to its unique property of turning green upon adding water to its dried bare roots. It is used as herbal medicine and an infusion (tea) is used as an antimicrobial treatment in cases of colds and sore throat[6].

General characteristics

Selaginella bryopteris is also known as Spike Moss Family as it grows in or on rocks and feed off moss, nutrients in rain water, litter, and even their own dead tissue. These usually have dichotomously branched stems, microphylls (small leaves), alternate, opposite or whorled, simple, one veined, sometimes dimorphic (two sizes), with scale like ligule (early deciduous). These are creeping or ascendant plants with simple, scale-like leaves on branching stems from which roots also arise. The plants are heterosporous (megaspores and microspores) [7] and have structures called ligules, scale like outgrowths near the base of the upper surface of each microphylls and sporophylls. Unusually for the lycopods, each microphylls contains a branching vascular trace. Roots borne on wiry rhizophores arising from forks in stems. Sporangia borne in axils of fertile leaves (sporophylls). Plants are heterosporous. Life cycle of Selaginella includes various stages having micro sporangia, megasporangia etc. Microspores are small, numerous, megaspores large, 4 per megasporangium[4].The gametophyte develops inside the megaspore. Chromosome count of *Selaginella bryopteris is* n=10.

Habitat

Selaginella grows on the hills of tropical areas, particularly the Arawali mountain terrains from east to west in India. *S. bryopteris* is known to be a heterosporous Indian Himalayan Pteridophyte occurring along the mountains and in fact, this herb is sold for this peculiar feature in several markets in India mostly in places of pilgrimage such as Rishikesh, Hardwar and Varanasi[8].The plants grow luxuriantly during rains exhibiting a lush green velvety landscape. During summer the plants undergo extreme desiccation. The fronds curl, become dry and virtually dead. In this condition they look like a closed fist hence often known in Unani as

'*punjemariam*' or '*hathazori*'. The dry plants when left in water unfold their fronds turn green and come back to active life. Several species of Selaginella have been used as potential herbal medicines. The dry plants have been used as a working remedy for several human health complications since centuries in India, particularly in the tribal areas. Traditionally, these plants are used by soaking them in water over night, preferably in an earthen pot[9]. Then, plants are discarded and water containing aqueous leaching is filtered and the filtrate is taken orally to cure the following mentioned health complications

1) Relief from heat stroke and the burning sensation during urination

2) Restoration of menstrual irregularities to normal

3) Helping in reducing labor pain for easy delivery of pregnant women

4) Curing Jaundice.

Therapeutic properties [10]

The most important bioactive compound in *Selaginella* species is bioflavonoid which are naturally occurring compounds that are ubiquitous in all vascular plants and have many favourable biological and pharmacological effects[11, 12]. It is known to resist drought very effectively for years. The reason behind its special power is due to the presence of drought resistant gene. The detached fronds of *Selaginella bryopteris* is being reported to have unique ability to survive desiccation similar to that of whole plant. So as to understand the mechanisms of desiccation tolerance, proteome studies were carried out using fronds of the *Selaginella bryopteris* to reveal proteins that were differentially expressed in response to dehydration and rehydration[13, 14]. A series of eleven bioflavonoid containing amentoflavone and hinokiflavone derivatives from *Selaginella bryopteris* had been investigated for their antiprotozoal activity using in vitro assays against the K1 strain of *Plasmodium falciparum, Leishmania donovani, Trypanosoma brucei, Rhodesiense and Trypanosomacruzi.* Out of these two bioflavonoid, it was observed that hinokiflavone is effective against HIV Infections. The aqueous extract of *S. bryopteris* possesses growth promoting activity as well as protective action against stress-induced cell death in a number of experimental cell systems including mammalian cells. *Selaginella* contains a variety of secondary metabolites such as alkaloids, phenol (flavonoids, tannins, saponins), and terpenoids (triterpene, steroid) [15, 16]. The main secondary metabolite of this plant is bioflavonoid, whose type varies depending on the species. Bioflavonoid that has been identified from *Selaginella*, among others amentoflavone, 2', 8''-biapigenin, delicaflavone, ginkgetin, heveaflavone, hinokiflavone, isocryptomerin,kayaflavone, ochnaflavone, podocarpusflavone A, robustaflavone, sumaflavone, and taiwaniaflavone.These compounds act

as antioxidants, anti-inflammatory, anti-cancer, anti-allergic, antimicrobial, antifungal, antibacterial, antiviral, protective against UV irradiation, vasorelaxant, heart boosters, antihypertensive, anti-clotting, and affect the metabolism enzymes. Bioflavonoid is a typical of secondary metabolites which are found only in Selaginallales, Psilotales, gymnosperms, and several species of Bryophytes and Angiosperms. Antifungal effect of amentoflavone derived from *Selaginella tamariscina* has paved way to the scientists to explore this antimicrobial property in *S.brypteris* also[17].

Reports on pharmacological activity of *Selaginella bryopteris.*

The following pharmacological activities of *Selaginella bryopteris* was reported and also shown in Table 1:

Antihyperglycaemic activity:

The aqueous extract of *Selaginella bryopteris* (150mg/kg b.w) when administered orally for 26 days was reported to reduce the level of glucose, total cholesterol, triglyceride, amylase, creatinine, urea and uric acid in swiss albino mice upon intraperitoneal administration of Alloxan (120mg/dl)[18].

Growth promoting activity:

A 10% aqueous extract of *Selaginella bryopteris* possesses growth-promoting activity by about 41% in *Sf9* cells and 78% in mammalian cells. Pre-treatment of cells with the *Selaginella bryopteris* aqueous extract for 1 h afforded complete protection against heat-induced growth suppression[19].

Antistress cell death:

One hour pre-treatment of cells with the *Selaginella* extract (SE) (1–2×5%) protected the cells against oxidative stress (H2O2) - as well as ultra violet (UV) induced cell death. The chemical analysis showed the presence of hexoses and protein which in turn possess anti-stress and antioxidant activities[19].

Antiprotozoal activity:

It was reported that *in vitro* assays against the K1 strain of *Plasmodium falciparum*, *Leishmania donovani*, *Trypanosoma brucei rhodesiense* and *Trypanosoma cruzi* was obtained by a series of eleven biflavonoids containing amentoflavone and hinokiflavone derivatives from *Selaginella bryopteris*. 7, 4′, 7″tri*O*methylamentoflavone reported to have *t*he highest antiprotozoal activity with an IC50 of 0.26 μM with no significant cytotoxicity (IC50 > 150 μM) when evaluated using L6 cells. 2,3dihydrohinokiflavone (IC50 = 1.6 μM) showed the strongest activity against *Leishmania*, whereas for *Trypanosoma* no significant activity was observed (IC50 > 12.5 μg/mL

for the extract). No significant activity was found against *Plasmodium* species when trimethylated amentoflavone were administered female NMRI mice at 50 mg/kg[20].

Antibacterial activity:

The methanolic extract of *Selaginella bryopteris* was reported to have antibacterial activity against six bacterial strains *Staphylococcus aureus* , *Niesseria gonorrohae* , *Pseudomonas aeruginosa, Escherichia coli, Streptococcus pyogenes, Bacillus subtilis* (microbes were obtained by American type culture collection) when antimicrobial activity was found using disc diffusion method phytochemical analysis, Minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC)[21].

Stomachache:

The ethanolic extract of *Selaginella bryopteris (L)* Bak was reported to reduce stomachache[22].

The paste of leaves of S.Bryopteris was reported to reduce Spermatorrhea, leucorrhoea and urinary tract inflammation in children[22]

Table 1: Pharmacological activities of *Selaginella bryopteris:*

Sr. No.	Pharmacological activities	Parts of Sanjeevani used
1	Antihyperglycaemic effect [18]	Aqueous extract of Sanjeevani plant.
2	Growth -promoting activity[19]	Aqueous extract of Sanjeevani plant.
3	Antistress cell death[19]	Aqueous extract of Sanjeevani plant.
4	Antiprotozoal activity [20]	Biflavonoids extracted from Sanjeevani plant.
5	Antibacterial activity [21]	-
6	Stomachache[22]	Stem of *Selaginella bryopteris (L).*
7	Spermatorrhea, leucorrhoea and urinary tract inflammation in children[22]	The paste of leaves of *Selaginella bryopteris (L).*

Recent Finding on Drought Resistant Gene of *Selaginella Bryopteris*

The scientists at National Botanical Research Institute (NBRI) working on the identification of the drought resistant gene in *Selaginella bryopteris*, and injecting the same into the corps plants so as to make them naturally resistant against famine, drought and snow [23]. The drought resistant gene in *Selaginella bryopteris* enables its survival in absence of water for several years.

Recent Report on Rhodiola - "Modern SANJEEVANI"

The leading scientist in India found a herb in the cold and highland climate of Himalayas where sustaining life is a challenge in itself. This herb is known as Rhodiola (Figure 2) and in local language known as "Solo"in Ladakh. The leafy parts of the plant were used as vegetable by locals. However, research by the Leh-based Defence Institute of High Altitude Research (DIHAR) is exploring the therapeutic values of the herb, which can regulate the immune system, help adapt to the mountain environment and, above all, protect from radioactivity. Rhodiola is a

wonder plant that has immunomodulatory [enhancing immune], adaptogenic [adapting to difficult climatic condition] and radio-protecting abilities due to presence of secondary metabolites and phytoactive compounds unique to the plant. This plant is known to resemble with the properties of Sanjeevani and also known as "Modern Sanjeevani"[24].

Figure 2: Rhodiola herb found in cold and highland climate[25].

CONCLUSION

From the present article, it can be concluded that herbs like *Selaginella bryopteris* and *Rhodiola* are herbs having several medicinal characteristics similar with Sanjeevani (A "life saving herb" as described in Indian epic "Ramayana"). Due to which both the herbs are also known as "Resurrection plant". Moreover, *Selaginela bryopteris* has been worshipped among local people as a magical herb owing to its medicinal properties. A plant of great importance to the society as a whole and a thorough study in terms of its therapeutic properties, ethonobotanical and phytochemical researches could upgrade the future prospect of this herb as a life saving plant.

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