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A mini review on medicinal properties of the resurrecting plant***Selaginella bryopteris* (Sanjeevani)**Reena Antony^{1*} and Rini Thomas²

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Abstract

Sanjeevani grows on the hills of tropical areas, particularly the Arawali Mountain terrains from east to west in India and is known to be a poikilohydric lithophyte occurring along the mountains and in fact, this herb is sold for this peculiar feature in several markets in India. In Hindu mythology, Sanjeevani (*Selaginella bryopeteris*) is a magical herb which has the power to cure any malady. *Selaginella* has been used traditionally to treat wounds and bleeding such as menstruation, uterine disorders and other internal injuries. *Selaginella* contains a variety of secondary metabolites such as alkaloids, phenol and terpenoids etc due which it can act as antioxidants, anti-inflammatory, anti-cancer, anti-allergic, antimicrobial, antifungal, antibacterial, antiviral etc. It is also used as a tonic to improve fitness and to expand life span. So it is important to explore more and more about this wonder herb so that it can be a "Jeanie" (master wizard for all desires) medicine for one and all in this world.

Key-Words: Selaginella, Sanjeevani, Ayurveda, Antioxidants, Resurrecting.

Introduction

Humans have always used plant in one capacity or another. Plants are becoming known more and more for their vital usage in many arenas, including medicinal purposes. In ancient cultures, medicine men used the extracts from plant life to soothe and relieve aches and pains. In the very beginnings of Botany, doctors in both Europe and America researched herbs in their quest to cure disease. Many of the plants that were discovered by ancient civilizations are still in use today. The leaves of willows, which contain a compound very similar to aspirin, were chewed by Native Americans to relieve aches and pains. The cinchona tree from South America used against malaria. Even today plants are being discovered that yield important and much needed medicines. As detailed above, plant life is a very vital part of human life; without plants, both land and sea dwelling, human life could not be sustained.

When there are plenty of illnesses, there are also plenty of herbs. To use medicinal herbs is more safe and natural way to heal our body and mind, than eating pills. Medicinal plants, herbs, spices and herbal remedies are known to *Ayurveda* in India since long times. In recent time the value of medicinal plants, herbs and spices as herbal remedies is being lost due to lack of awareness and deforestation. The result is many valuable medicinal herbs are becoming rare and precious information is lost. Less the pollution, more ecological balance we can maintain and can add to happiness to humankind. And we should also safely preserve the knowledge of medicinal plants, herbs, spices and herbal remedies, which humankind has received from the past generations, for posterity.

History of herbal remedies is very old. Since old times before the modern medicine, people became ill and suffered from various ailments. In absent of modern medicinal remedies people relied on herbal remedies derived from herbs and spices. There are many medicinal herbs like tulsi, neem, ¹⁻³ etc which find place in day-to-day uses, many of these, is used as herbal remedies. Even though the medical science has progressed; methods and ideas based on herbal healing have sustained and grown in different countries, across different cultures, often being used in exactly the same way. Many cooked foods contain spices. Some minor

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ailments like common cold, cough, etc may be cured by herbal remedies with use of medicinal properties of spices.

The growth of Ayurvedic and traditional medicine and as well as the increase in western herbalists helped in the identification, quality selection and appropriate processing of crude drugs. Traditional knowledge is also known as indigenous knowledge. It generally refers to the long-standing traditions and practices of regional, indigenous, and local communities and includes their wisdom, knowledge, and teachings. It often takes form of stories, legends, folklore, rituals, songs, and even customary laws and may be passed orally, from one generation to another. Traditional knowledge is often connected with medicinal properties of the plants and depends on the biodiversity of the place. It is rich in the communities with ancient culture and civilizations.

SANJEEVANI (literally meaning something that offers life; jeeva = life) Most mysterious and most sought-after herb in Indian Mythology Existence and identity are controversial Miracle herb – due to its alleged potentiality for ‘resurrecting’ life. Out of preliminary listing of about 17 plant species which could be Sanjeevani only three final species were shortlisted which were *Cressa cretica*, *Selaginella bryopteris*, and *Desmotrichum fimbriatum*. Out of which currently *Selaginella bryopteris* is considered as Sanjeevani.⁴ *Selaginella* existed before 300 million years and comes under a group of plants which were the first vascular plants on earth. (Fig.1)⁵

Scientific classification of *Selaginella bryopteris*

Kingdom: *Plantae*
Division: *Lycopodiophyta*
Class: *Isoetopsida*
Order: *Selaginellales*
Family: *Selaginellaceae*
Genus: *Selaginella*
Species

- *apoda*
- *asprella*
- *bifida*
- *biformis*
- *bigelovii*
- *braunii*
- *bryopteris*
- *canaliculata*
- *carinata*
- *cinerascens*

General Characteristics

The general characteristics of Selaginellaceae family of which *Selaginella bryopteris* is also known as Spike Moss Family includes plants that grow 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). Selaginellas 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), and have structures called ligules, scale-like outgrowths near the base of the upper surface of each microphyll and sporophyll. Unusually for the lycopods, each microphyll 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. (Fig 4) Microspores are small, numerous, megaspores large, 4 per megasporangium. The gametophyte develops inside the megaspore. Chromosome count of *Selaginella bryopteris* is n=10.

Habitat:-

Sanjeevani 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 poikilohydric lithophyte 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. The plants grow luxuriantly during rains exhibiting a lush green velvety landscape. **Sanjeevani booti (*Selaginella bryopteris*)** has been reported to have the highest degrees of drought resistance.⁷ 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.⁸ The dry plants have traditionally been used as a remedy for several human health complications for centuries in India, particularly by tribal peoples. *Selaginella* is said to be effective as follows:⁴

- 1) Relief from heat stroke and the burning sensation during urination
- 2) Restoring menstrual irregularities to normal
- 3) Helping in easy delivery of pregnant women (in minimizing the labor pain)

4) In the treatment of Jaundice

Mythology behind Sanjeevani

The popular name Sanjeevani which translates as "One that infuses life" derives from the medicinal properties of the plant. In Hindu mythology, Sanjeevani is a magical herb which has the power to cure any malady. It was believed that medicines prepared from this herb could revive a dead person. This herb is mentioned in the Ramayana when, Ravana (King of demons) hurls a powerful weapon at Lakshmana (brother of Lord Rama) who had killed his beloved son Indrajit. Lakshmana was badly wounded and was nearly killed by Ravana. When Lakshmana fell unconscious, near death, hit by an arrow from Ravana, Hanuman (beloved disciple of Lord Rama) approached the Lankan Royal Physician Sushena for advice. Sushena asked Hanuman to rush to Dronagiri Hills and fetch four plants: Mruthasanjeevani (restorer of life), Vishalyakarani (remover of arrows), Sandhanakarani (restorer of the skin) and Savarnyakarani (restorer of skin colour).⁹

Hanuman, not able to pick the four from the multitude, brought back the entire hill. And Lakshmana was revived from near death back to life. In various Vedic texts and also in Ramayana it has been clearly mentioned that sanjeevani booti glows in the dark. When made slightly wet and kept in dark it glows; emits light. Its properties and usage has also been described.¹⁰

Therapeutic properties:

Natural products have long been a thriving source of new drugs due to their chemical diversities and ability to target various biological targets.¹¹ *Selaginella* is one such plant who ought to be studied well so that the array of medicinal properties it has as stated in mythological stories can be explored and used. *Selaginella* species have a large number of bioactive compounds, the most important being bioflavonoid.¹²,¹³ Biflavonoids are naturally occurring compounds that are ubiquitous in all vascular plants and have many favorable biological and pharmacological effects.¹⁴,¹⁵,¹⁶. (*Selaginella bryopteris*) has been reported to have the highest degrees of drought resistance. It is observed that this fern can withstand years of drought very effectively, and still there is no adverse effect in its vigor. The cause for this special power lies in its drought resistant gene. The detached fronds of *Selaginella bryopteris* have been said to have unique ability to survive desiccation similar to that of whole plant. In order 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. A series of eleven biflavonoids 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 *Trypanosoma cruzi*. Out of these two biflavonoids hinokiflavone is also effective against HIV Infections too.¹⁷⁻¹⁸

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).¹⁹ The main secondary metabolite of this plant is biflavonoid, whose type is various depending on the species. Biflavonoid 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.²⁰ Biflavonoid is a typical of secondary metabolites which are found only in Selaginellales, Psilotales, gymnosperms²¹, and several species of Bryophytes and Angiosperms.²² *S. bryopteris* is treated as anti-inflammatory and cures venereal disease²³, its usage is also known by local indigenous people, such as Songhati people.²⁴ Antifungal effect of amentoflavone derived from *Selaginella tamariscina* has paved way to the scientists to explore this antimicrobial property in *S. bryopteris* also. Interest in natural products with antimicrobial properties has revived due to the current problems associated with the use of antibiotics. This evidence contributes to support and quantify the importance of screening of natural products like *Selaginella*.²⁵

Conclusion

Several species of *Selaginella* are also used as food (raw vegetables), ornamental plants, handicrafts materials as well as socio-cultural and packaging materials. The utilization of *Selaginella* is very limited compared to the number of species and the potential benefits of the medicine, so it requires further ethnobotanical and phytochemical researches.

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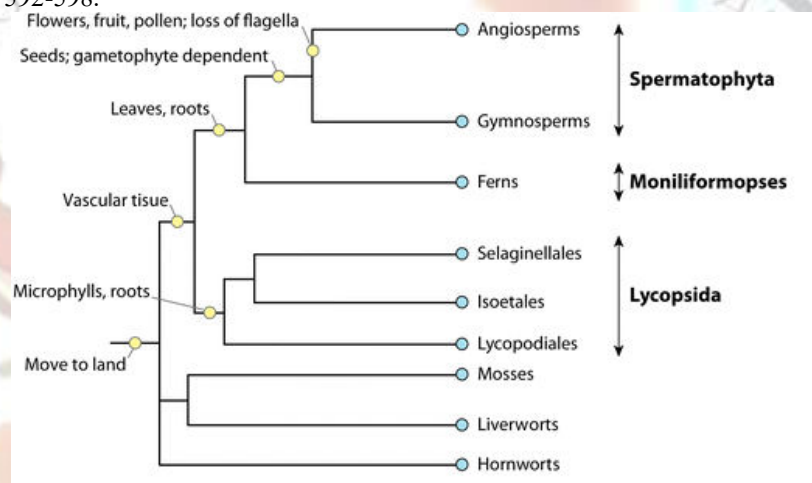


Fig 1: Showing correlation with primitive plants ⁵



Fig 2: *Selaginella bryopteris*



Fig 3: *Selaginella bryopteris* on rocks

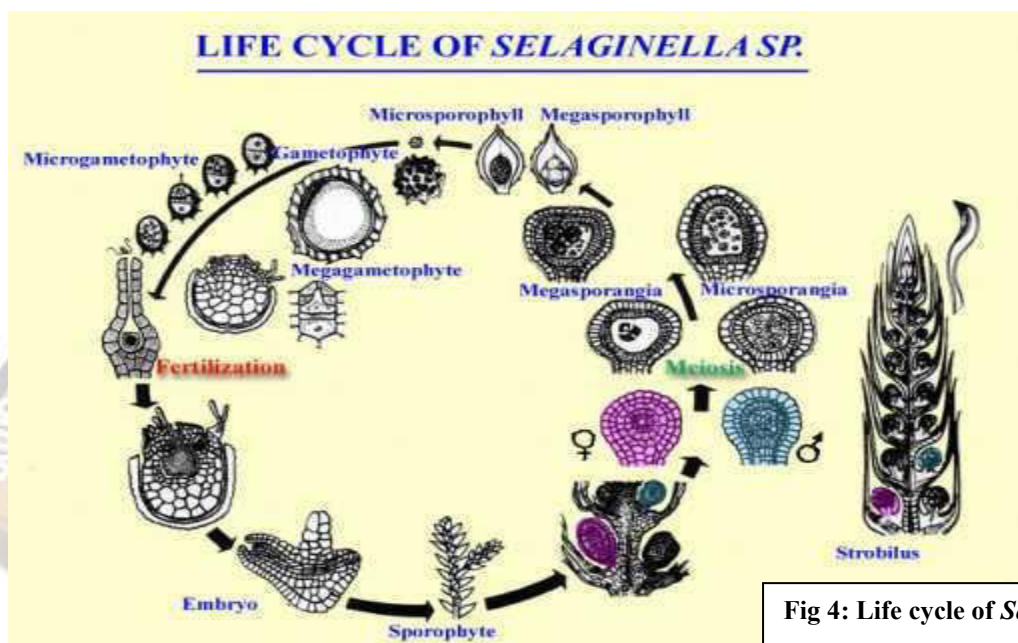
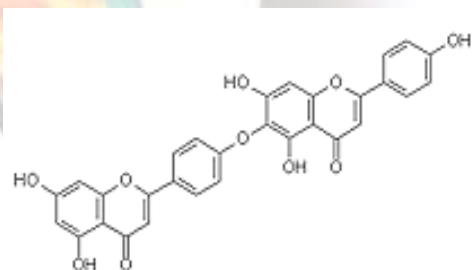
Fig 4: Life cycle of *Selaginella* sp.Fig 5: Dried *Selaginella bryopteris*Fig 6: Picturistic depiction of Hanumana carrying Dronagiri Mountain⁹

Fig 7: Structure of Hinokiflavone

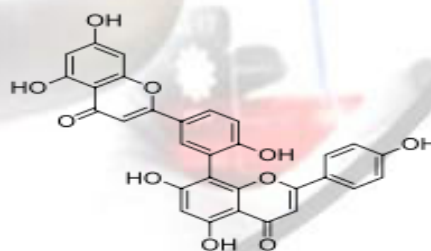


Fig 8: Structure of Amentoflavone

Table 1: Table showing botanical/common names of the three short listed plants to be named as Sanjeevani

BOTANICAL NAME	COMMON NAME (IN SANSKRIT) ⁴
<i>Cressa cretica</i>	Sanjeevani, Amruthashraava, Rudanthi, Madhushraava, Romaanchika
<i>Selaginella bryopteris</i>	Sanjeevani, Sanjeevani Bhoothi
<i>Desmotrichum fimbriatum</i>	Jeevaka, Jeeva, Jeevabhadra, Jeevavani, Jeevanthi, Jeevapathra, Jeeva pushpa, Jeevavardhini, Jeevadhaathri, Jeevya, Rakthaanthi, Yashasya, Sukhankaari, Praanadha

Table 2: Enumeration of some of the Indian Species of Selaginella ⁶

Species	Characteristic features
<i>S.sanguinolenta</i>	Stem is red
<i>S.vaginata</i>	Stems not red, stems prostrate ,rooting throughout, Arista of sorsal leaves short
<i>S.pallida</i>	Arista of dorsal leaves more than half as long as lamina
<i>S.bryopteris</i>	Stems rooting at the base only or up to about the middle portion , usually suberect, Sporophylls of spikes uniform, Leaves uniform at the base of the main stem,plants xerophytic,dorsal leaves aristate
<i>S.fulcrata</i>	Stem leaves distant, dorsal leaves lanceolate, strongly ciliate at the base
<i>S.involvens</i>	Stem leaves continuous, dorsal leaves ovate, minutely dentate at the margin
<i>S.repanda</i>	Leaves dimorphic throughout, Ventral leaves at the base of the stem continuous, spreading ,ciliate at the base
<i>S.delicatula</i>	Ventral leaves distant towards the base of the stem, oblique, denticulate at the apex
<i>S.pallidissima</i>	Sporophylls of spikes dimorphic, smaller sporophylls in the same plane as the dorsal leaves