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Sedum rosea Linn: A phytopharmacological review

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ABSTRACT

Medicinal plants are the nature's gift to human being to make disease free healthy life. *Sedum rosea* Linn (Crassulaceae) is an important medicinal plant of tropical and subtropical India. Its medicinal usage has been reported in the traditional systems of medicine such as Ayurveda, Siddha and Unani. *Sedum rosea* has been described as a passion flower and has been used extensively for treatment of some diseases like as; antiscorbutic, antipyretic and calmative properties. The present article includes the detailed exploration of phyto-pharmacological properties of *Sedum rosea* referring to the rose-like attar of the fresh cut root stock. Its properties remain largely unknown in the west is an attempt to provide a direction for further research.

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KEYWORDS

Sedum rosea Linn;
Rhodiola rosea;
Medicinal plant;
Adaptogenic;
Rose root.

INTRODUCTION

Plants have always been a common source of medicament either in the form of traditional preparations or pure active principles. In survey done by WHO it has been estimated that 80% of more than 4,000 million inhabitants of the world rely on traditional medicines for their primary health care needs and it can be safely be presumed that a major part of traditional therapy involve use of plant extracts or their active principles. There is a growing interest in herbal remedies because of their effectiveness, minimal side effects in clinical experience and relatively low costs. Herbal drugs or their extracts are prescribed widely, even when their biological active compounds are unknown. Even the World Health Organization (WHO) approves the use of plant drugs for different diseases.

The current taxonomical status of the genus sedum has become quite complex. Before World War II, some taxonomists separated different species of *Rhodiola* into

an independent genus, belonging to the subfamily *Sedoidae*. Then *Rhodiola* was reclassified as a subgenus of the larger genus *Sedum*, which contained about 5 species. *Rosea* grows primarily in dry sandy ground at high altitudes in the arctic areas of Europe and Asia^[2]. The Asian distribution includes polar Arctic and alpine regions in the Altai Mountains, Eastern Siberia, Tien-Shan, the Far East, and south to the Himalayan Mountains where the taxon is usually recognized as subsp. *Integrifolia*^[3].

The plant reaches a height of 12 to 30 inches (70cm) and produces yellow blossoms. It is a perennial with a thick rhizome, fragrant when cut. The Greek physician, Dioscorides, first recorded medicinal applications of *Rodia riza* in 77 CE. in *De Materia Medica*. Linnaeus renamed it *Sedum rosea* referring to the rose-like attar of the fresh cut root stock^[4]. *S.rosea* has been extensively studied as an adaptogen with various health-promoting effects, its properties remain largely unknown in the West. This review provide an introduction to some

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of the traditional uses of *S. rosea*, its phytochemistry, scientific studies exploring its diverse physiological effects, and its current and future medical applications. Several species of the genus *Sedum* have been identified which are given following^[5].



Sedum rosea flower



Sedum rosea – Roots



The whole plant

- *Sedum acre*
- *Sedum purpureum*
- *Sedum sarmentosum*
- *Sedum ternatum*
- *Sedum telephoides*

The figures show the various parts of the plant *Sedum rosea*.

GEOGRAPHICAL DISTRIBUTION

Genus may have originated in the mountainous regions of Southwest China and the Himalayas^[6]. The genus is distributed from the Altai Mountains across Mongolia into many parts of Siberia^[7].

Synonym

Rhodiola rosea L., Golden root, Rose root.

Classification

Botanical source : *Sedum rosea* L.

Family : *Crassulaceae*

Genus : *Sedum*

Species : *Sedum rosea*.

MORPHOLOGICAL CHARACTERISTICS

Weed description

Sedum rosea L. roseroot (golden root or Arctic root) is an herbaceous perennial plant of the family Crassulaceae. Plants are perennial herbs; 5-20cm high; succulent, dioecious, with numerous leafy stems.

Seedlings

Due to the slow-growing characteristic of, *Sedum* the age of the seedlings has a great effect on the plant growth and the root yield. The optimal spacing for roseroot seedling seems to be 40×40 cm. The theoretical plant density of plant populations is about 110,000 plants/ha^[8].

Roots

Roots erect, robust. The dried root smells strongly of roses. Tap root present. Ground-level or underground stems horizontal, or vertical and often branched; 10-50mm wide.

Leaves

Leaves distributed along the stems; alternate (some-

times pseudo-whorled); simple; existing for a single season or less. Petiole absent, blades 10–40mm long; 2–10mm wide. Blades *succulent*; straight; oblanceolate (somewhat spoon shaped); with inconspicuous veins.

Stems

Aerial stems erect (thick, fleshy, scaly, fragrant when cut, sometimes numerous and leafy); glabrous.

Flowers

Flowers small, less than 5 mm in diameter or length (individual flowers) or large, more than 15 mm in diameter or length (cluster of many flowers that might be interpreted as a single flower).

Fruit

Fleshy; a follicle (3–6 follicles); elongate-cylindrical; dehiscent (opening dorsally). Fruit 4–6mm long; 3–5mm wide, pale red hairy. Seed 0.5–1 mm long^[3].

IDENTIFYING CHARACTERISTICS

The plant reaches a height of 12 to 30 inches (70cm) and produces yellow blossoms. It is a perennial with a thick rhizome, fragrant when cut^[4]. The perennial plant grows in areas up to 2280m elevation. Several shoots grow from the same thick root. Shoots reaches 5 to 35cm in height.

PHYTO-CONSTITUENTS

The investigation of the phytochemistry of *S. rosea* root has revealed the presence of six distinct groups of chemical compounds:

- Phenyl propanoids: rosavin, rosin, rosarin (specific to *R. rosea*)
- Phenyl ethanol derivatives: salidroside (rhodiolide), tyrosol
- Flavanoids: rodiolin, rodionin, rodiosin, acetylrodalgin, tricrin
- Monoterpenes: rosiridol, rosaridin
- Triterpenes: daucosterol, beta-sitosterol
- Phenolic acids: chlorogenic and hydroxycinnamic, gallic acids^[9,10,11].

Pharmacologically, *sedum* and its main active component, salidroside has pronounced and well documented and adaptogenic action^[12]. Dubichev and col-

leagues demonstrated that *S. rosea* root contains three cinnamyl alcohol-vicianosides-rosavin, rosin and rosarin that are specific to this species^[13].

There are many other constituent phenolic antioxidants, including proanthocyanidins, quercetin, gallic acid, chlorogenic acid and kaempferol^[7].

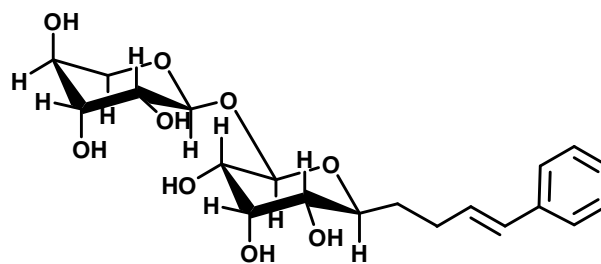
SEDUM ROSEA IN TRADITIONAL MEDICINE

Sedum rosea L. (*Rhodiola rosea*) is used by indigenous population of the Altai as an agent for increasing vital activity^[15]. Traditional folk medicine used *S. rosea* to increase physical endurance, work productivity, longevity, resistance to high altitude sickness, and to treat fatigue, depression, anemia, impotence, gastrointestinal ailments, infections, and nervous system disorders. In middle Asia, *S. rosea* tea was the most effective treatment for cold and flu during severe winters. Mongolian doctors prescribed it for tuberculosis and cancer^[16].

Among the 175 most important Tibetan drugs in the Handbook of Traditional Tibetan Drugs, *Sedum* is mentioned in ten formulations, of which nine are indicated for lung disorders^[12].

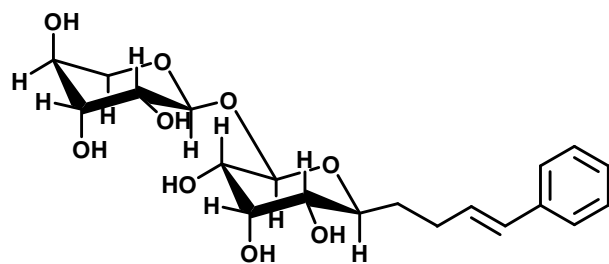
Professional athletes use this plant for increasing physical activity, stimulating anabolic process in skeletal muscles, increasing endurance during maximum physical exercise and promoting subsequent recovery of cardiovascular system. German researchers described the benefits of *S. rosea* for pain, headache, scurvy, hemorrhoids, as a stimulant, and as an anti-inflammatory. Linnaeus wrote of *S. rosea* as an astringent and for the treatment of hernia, leucorrhoea (vaginal discharge), hysteria, and headache^[4,17].

The traditional use of *S. rosea* as a tonic in Siberian and Russian medicine stimulated extensive research leading to identification of *S. rosea* as an adaptogen, a substance that nonspecifically increases the resistance of an organism and does not disturb normal biological

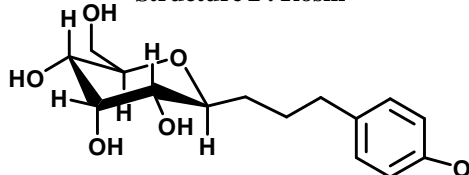


Structure 1 : Rosavin

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Structure 2 : Rosin



Structure 3 : Salidroside

TABLE 1 : Secondary metabolites of *sedum rosea*^[14]

Sr. No.	Chemical Group	Reference
1	Phenylpropanoid glycosides	Zapesochnaya and Kurkin 1983, Brown <i>et al.</i> 2002, Troshchenko and
2	Phenylethanol derivatives	Kutikova 1967, Brown <i>et al.</i> 2002
3	Flavonoids	Kurkin <i>et al.</i> 1983, 1984, Brown <i>et al.</i> 2002
4	Terpenes	Kurkin <i>et al.</i> 1986. Bely <i>et al.</i> 1994, Rohloff 2002
5	Phenolic acids	Brown <i>et al.</i> 2002
6	Coumarins	Furmanova <i>et al.</i> 1995
7	Lactones	Furmanova <i>et al.</i> 1995

TABLE 2 : Formulations available in trade

Name	Formulation	Use	References
Neurocalm	Root extract	Positive effects on nervous system, support normal mood	www.symmcorp.com/info/rhodiolarosea.htm
Rhodiola Powder	-	Cardiovascular and cerebral health, blood pressure and sugar control, immune support/antifatigue and anti-stress	www.healthkingenterprise.com/rhodiolapower.htm
Anti-aging medicine of 21 st century	Dry roots, dry extracts, tablets	Anti-aging	www.anti-aging-guide.com/RhodiolaRosea.html
Solarly Rhodiola Extract	Capsules	Herbal product for natural well-being	www.americanherbalcompany.com/proddetail.cfm
Clear Mind	Capsules	Memory, brain tonic	www.iherb.com/rhodiola.html
Protein energizer	Syrup rice protein	For general health, in combination with spirulina, Ginseng,	www.iherb.com/rhodiola.html
Ginza-plus	Liquid gel capsules	In combination with ginseng, Maca, schizandra, cordyceps etc.	www.iherb.com/rhodiola.html
Rhodiola energy cap.	Capsules	Memory, Anti aging	www.iherb.com/rhodiola.html
(T2) planetary formula	Tablets	Anti-stress	www.iherb.com/rhodiola.html
Arctic roots	Tablets	Antifatigue and anti-stress	www.iherb.com/rhodiola.html
Rhodiola Now Foods	Vcapsules	Immune support	www.iherb.com/rhodiola.html
Bodyonics	Capsules	Positive effects on nervous system	www.iherb.com/rhodiola.html
Paradise herbs	Capsules	Cognitive stimulant, emotion calming agent	www.iherb.com/rhodiola.html
Yellow emperor, rosea extract	Spray bottles	Anti-aging	www.yellowemperor.com/theproduct/Liquidextracts
Siberian Rhodiola, Longevia Rhodiola	Capsules	Anti-stress, positive mood support and memory-enhancing	www.smartbomb.com/supplements-herb-rhodiola.htm
Vita tonic	Rhodiola extract	Anti-stress, positive mood support, and memory-enhancing	www.shopping.lycos.co.uk/1915en933.html
Rhodila rosea	Sliced roots formula	Anti-aging	www.nutricentre.com/store/naturalexirstore/longevity/18.htm

Sedum rosea and its formulation

parameters. The stimulant effect of *Sedum rosea* increases working capacity, tolerance to anorexia, resis-

tance to microwave irradiation and poisoning by toxins. According to several Norwegian reports, in the eigh-

teenth century the plant was known as an effective remedy for scurvy^[11]. Rats treated with *Sedum rosea* extract showed improved learning behavior in a maze model 24 hours after treatment. Significant improvement of long-term memory has also been established using memory tests after 10 days' treatment^[12].

It is claimed that the leaves can be used like *Aloe vera* leaves to soothe burns, bites, and other irritation. A paste from the root has been used to help in wound healing. They may also have anti-cancer properties, a stimulating effect on the central nervous system and the effect of protecting the liver^[3]. In Russia and Scandinavia, *Sedum rosea*, also known as golden root, has been used for centuries to cope with the cold Siberian climate and stressful life^[18].

It has an enhancing effect upon physical endurance and sexual potency. A decoction of the flowers has been used to treat stomach aches and intestinal discomfort. The raw flowers have been eaten in the treatment of tuberculosis^[19].

PHARMACOLOGICAL STUDIES OF *SEDUM ROSEA* L.

Anti-fatigue activity

The study was intended to investigate the efficacy of a standardized extract from *S. rosea* rhizome in non-specific fatigue. The anti-fatigue effect of *S. rosea* preparation using repeated low-dose regimen in healthy volunteers during work-related fatigue was evaluated^[12].

Pharmacological action on central nervous system

Small and medium doses of the plant were found to have a stimulating effect, such as lengthening the time mice swim and remain on vertical perches to the limit of their abilities. Medium range doses, unlike tranquilizers, enhanced the development of conditioned avoidance reflexes in rats and facilitated learning based on emotionally positive reinforcement^[12,20,21]. The antidepressant activity of some phytopreparations was studied on white rats, which were subjected to the desperation test and neuropharmacological tests based on the antagonist activity with respect to reserpine, clofelin, and L-DOPA^[22].

Antioxidant and Anti-carcinogenic activity

S. rosea is rich in phenolic compounds, known to

have strong antioxidant properties^[23,24]. It is able to significantly protect, in a dose-dependent manner, human RBC from glutathione (GSH) depletion, glyceraldehyde-3-phosphate dehydrogenase (GAPDH) inactivation and hemolysis induced by the oxidant^[25]. Animal studies have shown that *S. rosea* decreases toxicity from cyclophosphamide, rubomycin, and adriamycin (anti-cancer drugs), while it enhances their anticarcinogenic effects^[26]. *Udintsev et al* showed that rose root extract (minimum 0.8 percent salidroside and 3 percent rosavin) increased the antitumor effect of the drug adriamycin while substantially reducing its liver toxicity^[27]. Many chemotherapy agents are hematotoxic (reduces the number of normal blood cell precursors in bone marrow) or hepatotoxic (causes damage to the liver). These serious side effects were significantly ameliorated by the plant extract. Thus, the research suggests that it can both enhance tumor inhibition by chemotherapeutic drugs while alleviating dangerous side effects.

Cardio protective activity

Cardioprotective effects of *S. rosea* include: prevention of stress induced cardiac damage, decreased myocardial catecholamine and cyclic adenosine monophosphate (cAMP) levels and reduced adrenal catecholamine release^[28,29]. The course of administration of *Sedum rosea* extract was studied for effects on the pattern of stress-induced cardiac damage which was assessed by ^{99m}Tc-pyrophosphate accumulation in the heart. *Sedum rosea* was found to prevent stress-induced cardiac damage. Simultaneously, myocardial catecholamines and cAMP levels were measured. It was ascertained that plant prevent both stress-induced catecholamine release and higher cAMP levels in the myocardium. Moreover, the adaptogen prevented lower adrenal catecholamines during stress. Thus findings suggest that the antistressor and cardioprotective effects of *Sedum rosea* are associated with limited adrenergic effect on the heart^[28].

Endocrine and reproductive effects

Neuroendocrine animal studies showed that *S. rosea*, like other adaptogen, enhanced thyroid function without causing hyperthyroidism^[29]. In addition, the thymus gland functioned better and was protected from the involution that occurs with aging. The adrenal

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glands functioned with better reserve and without the kind of hypertrophy caused by other psychostimulants. Egg maturation was enhanced in rats and an anabolic effect in males (increase muscle building and gonad strengthening similar to effects of low dose testosterone) was observed. Using the *in vitro* estrogen receptor competition assay, it was found that *S. rosea* extract showed strong estrogen binding properties that require further characterization. In an open study, 26 out of 35 men with erectile dysfunction and/or premature ejaculation (of 1-20 years duration) responded to *S. rosea* (150-200mg/day for 3 months) with substantially improved sexual function, normalization of prostatic fluid, and an increase in 17-ketosteroids in urine^[30,31].

Effects on physical activity

A number of studies have shown that *S. rosea* increased physical work capacity. The effects of oral treatment with extracts from *Sedum rosea* roots on the duration of exhaustive swimming and ATP content in mitochondria of skeletal muscles in rats. Treatment with *S. rosea* extract significantly (by 24.6%) prolonged the duration of exhaustive swimming in comparison with control rats. *S. rosea* is most effective for improving physical working capacity^[32]. Repeated use of CNS stimulants depletes brain catecholamines and decreases conditioned reflexes. In contrast, with extracts of *S. rosea*, the initial increase in work-capacity is followed by a lesser diminution, such that the work-capacity continues to be above average^[33].

Adaptogenic and anti-stress activity

Adaptogen are the agents that allow an organism to counteract adverse physical, chemical, or biological stressors by generating nonspecific resistance. *S. rosea* has been categorized as an adaptogen by Russian researchers due to its observed ability to increase resistance to a variety of chemical, biological, and physical stressors. Adaptogens reduce damage from stressors by altering the reactivity of the organism's defense system, including the hypothalamic pituitary axis (HPA) and the efferent sympatho-adrenal system^[33].

Adaptation is required to successfully combat stress and stressful situations. Adaptation might be best thought of as the ability to be exposed to a stressor,

while responding with either decreased or uncharacteristic hormonal perturbations. Adaptation also implies being prepared to and capable of rapidly re-assuming homeostasis after the stressor is withdrawn. The main effects of adaptogens are an increased availability of energy during the day, a reduction in stressed feelings, increased endurance, greater mental alertness, and deep and restful sleep. *S. rosea* extracts also protect the brain and heart by reducing the secretion of corticotrophin releasing factor (CRF) under stress^[29,30].

Hepatoprotective activity

The liquid extract from *Sedum rosea* on functional state of rat liver with experimental toxic hepatitis was studied. The extract produces a hepatoprotective effect, as manifested by normalized activity of aspartate aminotransferase and alkaline phosphatase, normalized content of medium molecular weight peptides, urea, bilirubin and reduced activity of alanine aminotransferase and glutathione-S-transferase in blood plasma of rats with toxic hepatitis model^[34].

Antipyretic activity

The ethanolic, petroleum ether, ethyl acetate and chloroform extracts were evaluated for antipyretic activity using Brewer's yeast induced pyrexia in albino rats of Wistar strain. All the four extract showed significant ($p < 0.05$) antipyretic activity^[35].

CONCLUSION

Our review concludes that, therapeutic efficacy of *Sedum rosea* extensively used in Traditional system of medicine has been established through modern testing and evaluation (pre-clinical and clinical trials) in different disease conditions. These studies place this indigenous drug a novel candidate for bioprospection and drug development for the treatment of such diseases as Antipyretic, antiscorbutic, antifertility, cardioprotective, hepatoprotective activities, anemia. The medicinal applications of this plant, countless possibilities for investigation still remain in relatively newer areas of its function. Hence, phytochemicals and minerals of these plants will enable to exploit its therapeutic use.

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