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Scientific Review on Sarala: Pinus roxburghii Sarg.

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ABSTRACT
Background: The Pinus roxburghii Sarg. is a coniferous tree that produces pine cones that are gymnosperm (naked seeds). This species has dark-brown, thick deeply longitudinal fissured bark. The leaves are grouped three per bundle, slender, flexible, and are flabellate-triangular at the cross sections. The Pine cones are shortly pedunculate and ovoid in shape. The seed cones have oblong, thick, stiff scales. Ever since ancient times, medicinal plants recognized as major source of therapeutics, as rescue for human diseases and maintain health. There is an exponential increase in usage of green medicines due to less cost and fewer side effects. The family Pinaceae, is largest conifer in species diversity. Pinus roxburghii Sarg. (syn. Pinus longifolia Roxb.) (Pinaceae), found in the Himalayan region, furnishes an oleo-resin which is used as insecticides, disinfectants and liver disorders. P. roxburghii are reported to have wound healing, cytotoxic, antibacterial, antifungal and spasmolytic actions. The plant also shows beneficial effects in the treatment of cough, ulceration and Genito-urinary disorders. Folklore reports suggest its use in inflammations, asthma, chronic bronchitis, piles, diseases of the liver and spleen, urinary discharges, toothache, tuberculosis, scabies and epilepsy. **Methods:** Regarding the Plant reviewed from scientific journals, books, and reports via electronic search tools (Medline, PubMed etc.) **Results:** This review summarizes the existing information of Pinus in relation to their pharmacognostic properties, phytochemistry, ethnobotany and pharmacological activities, apart from heartwoods and other part.
Key words: Pharmacognosy, Pinus roxburghii, Phyto- chemistry, ethnopharmacology, Ethnobotany.

I. INTRODUCTION:

Pinus roxburghii Sarg. (Pinaceae), commonly known as Chir Pine, is a tall tree with a spreading crown found in the Himalayan from Kashmir to Bhutan, Afghanistan and in southern Indian hills. Pinus roxburghii Sarg. is the only tree with an ornamental specimen and having different medicinal values found in the Himalayan region of Bhutan, Nepal, Kashmir, Sikkim, Tibet and other parts of North India. The plant is belonging to family Pinaceae commonly known as Chir Pine they are the largest conifer's families in the world and always remain evergreen woody conifer trees.The plant Shri, Shriniketa, Shrivasa, and Shriveshtaka mentioned in classics are all referred for Sarala. Charaka and Sushruta mentioned Sarala at many places along with Devadaru. It is extensively used plant in the Ayurvedic literature.It consists of 110–120 species distributed throughout temperate regions of the Northern Hemisphere, and more than 40 taxonomic treatments have been recognized of several major divisions within the genus. Chir trees are abundantly present and have ethno medicinal value, nuts are traditionally consumed in India and Pakistan.The plant extracts possess medicinal properties and are often used as sweetening agent, colouring agent, preservatives in many medicinal formulations.The chief chemical constituents of turpentine oil from Pinus roxburghii Sarg. are α-pinene, β-pinene, car-3-ene and longifolene hydrocarbons (d- and l-pinene), resin acids, camphene, fenchene, dipentene, and polymeric terpenes.Pinus roxburghii has been widely used as a traditional remedy by the local tribes in various parts of Northern India. The wood oil is antiseptic, diaphoretic, rubefacient, aromatic and carminative in nature. It is used as nerve tonic and expectorant and as remedy for diseases of the eye, ear, pharynx, haemorrhages, worm infestations and skin.It is also used as remedy for neuralgia, minor haemorrhages of tooth sockets and also recommended in gangrene of lungs.

Pharmacognosy: Pinus roxburghii
Habitat and morphology
Pinus roxburghii Sarg. (Pinaceae) is an older terres-trial ornamental plant in the world. It is the most important pine of North Western Himalayas and an important resin and timber yielding species. In India it is found in Himachal Pradesh, Kashmir and Uttaranchal. It is a large tree with spreading crown

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reaching 30-50 m with a trunk diameter of up to 2 m. It is found at the height of 500 to 2,500 m above sea level and grows gregariously. It is a large tree with branches in more or less whorled, bark dark gray, often reddish, deeply fissured, rough, exfoliating in longitudinally elongated plates. Wood moderate hard, sapwood white; heartwood brownish red; annual rings very distinct, many fine, rough irregular; medullary rays; resin ducts large numerous, irregularly distributed, prominent on vertical section. leaves in clusters of three, 20-30 cm, long, triquetrous, finely toothed, needle like, light green, persisting on an average for a year and a half; male flowers about 1.5 cm long, arranged in the form of cones, female cones, solitary or 2-5 together, ovoid, 10- 20 cm×7.5×13 cm when ripe. The tapping of the stem produces clear, transparent oleo-resin with the pungent and bitter taste. Taxonomy and common names of Pinus roxburghii Sarg are shown in Table1.

Table 1: Taxonomy of Pinus rox burghii.

Taxonomic classification	Synonym	Common names
Kingdom: Plantae	*Pinus longifolia*	English: Long leaved Pine or chir pine
Division: Pinophyt		Hindi: Chil, Chir, Salla
Class: Pinopsida		Sanskrit: Manojna
Order: Pinales;		Gujrati name: Teliyodeodaro
Family: Pinaceae		Bengali: Saralgachhai
Genus: *Pines*		Malyalam: Salla, Charalam
Subgenus : *Pines*		Tamil :Simaidevadari
Species: *Pinus roxburghii* Sarg.		Telgu: Devadaru

Kinds and Varieties:

There are a number of pine species naturally occurring in the Himalayas and many of them are introduced being exotic species. Some important species found in various Himalayan regions in country to varying extents, such as Pinus gerardiana Wall., Pinus insularis Endl. And Pinus Wallichiana A.B. Jackson. Nearabout 12 exotic species of pinus or kinds of pines are reportedly tried in India and further work on their different aspects have experimentally been conducted including regeneration, production, chemistry, Utility etc.

Flowering and fruiting time:

Plant bear male flowers in January and fruit become matured by next year June- July; and cones begin to April-may of third year i.e. about 24 months after their appearance.

Classical Categorization:

Caraka: Purisavirajaneeya
Susruta: Eladi
Vagbhata: Eladi
Ayurvedic Properties:
Rasa: Katu, tikta, madhura
Guna: Laghu, tikshana, snigdha
Virya: Usna
Vipaka: Katu
Dosakarma: Kaphavatasamaka

Important formulations:

Karpuradyarka, Rajanyadi churna, Sudarshana churna.

Therapeutic Uses:

Karnaroga, Kantha roga, Aksiroga, Daha, Murccha, Vrana, Kasa, Yuka, Swarabhramsa.
Parts used: Wood, oleo- resin, oil.
Dose: Wood powder 1-3 gm, oil 1-3 drops, oleo-resin (Shrivestaka) 1-3gm.

Traditional and ethnobotanical use of Pinusroxburghii sarg:

The knowledge of traditional medicines (also known as indigenous or folk medicine) is passed on generation over generation by natives of Uttrakhand. Currently, no written data is available for this medicinal stock bur it is kept preserved by oral transmission to generation aftergeneration. These traditional medicines are commonly applied as cure for many diseases since initial human civilization. Several useful products from Chir pine like resin, needle oil, seeds, are extensively used to

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cure different health problems summarized in table2. The resinous wood of P. roxburghii is burnt and the soot is collected in a metallic disc placed inversely over the flame. This collected soot is then mixed with mustard oil to made a paste (Kajal), which is applied inside the lower eyelids to keep the eyes clean and attractive. Bark is utilized as a supplement (pycnogenol), powerful antioxidant and free radicals scavengers in some cardiovascular and heart disease treatments. The bark contains tannins and some other coloring matter, and therefore sometimes used for coloring the leather. The bark from the roots and stem is also exhibits antidiabetic properties.

Table2: Traditional and ethnobotanical uses of different parts of Pinus roxburghii sarg.

Parts used	Traditional use
Leaves	Leaves(needles) are used to increase the flow of urine (diuretic), prevent soil erosion[28], used for sheltering and for keeping fruits in crates decoction of leaves is applied locally to treat sprains.[29]
Wood	Wood is used to cool the burning sensation of the body[30], emollient, aromatic, antiseptic, deodorant, haemostatic and diuretic. Stimulant, anthelmintic, digestive, liver tonic, diaphoretic and useful in eye, ear and pharynx disease, foul ulcers, haemoptysis, worm infection, flatulence, liver diseases, bronchitis inflammation, use for skin disease[31], pruritus and giddiness, fuel wood[32],wood oil is used as a nerve tonic, expectorant, burns and cracks, resinous wood is applied inside the lower eyelids to keep the eye clean and attractive.[33]
Bark	Fuel wood, bark paste is used in burns and cracks, used for skindiseases and ulcers.
Oil/turpentine oil	The turpentine oil is rubefacient, in the form of Linimentum Terebinthinae and Linimentum Terebinthinae Aceticum, in chronic rheumatism[34] Used as diuretic.
Resin	Plant resin is applied locally on the pimples for about 2-3 hours daily, resin is employed as a stimulating application for ulcer and abscesses and as basis for plaster, used in snake bite and scorpionsting, used for painful

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	chest, skin disease and blood purifier, oleoresin is thermogenic, expectorant, anodyne, anti-inflammatory, purgative, rubefacient, vermifuge and demulcent, 2 g of resin with an equal amount of common salt is boiled in 250-300 ml of water and drunk warm before bedtime for 2-4 days to cure cough, cold, asthma, chronic bronchitis, liver and spleen disease, kidney and bladder, gonorrhea, scurvy, epilepsy, haemorrhoids and tuberculosis, it is used in steam bath for the treatment of rheumatic infections, Resin is applied on boils, pimples and blisters, pus formation.[35], heel cracks, above the eye to remove swelling[36] used in broken ceramic pottery, used in cuts and wound
Seed	Roasted seeds are eaten as a galactagogue edible and source of oil.[37]

Chemical Composition:

Oleoresin is obtained by incision in trunk of trees under two methods of tapping (light and heavy tapping); and the oleoresin product is known as Sarala niryasa or Shrivestaka (Gandhabiroja) which is source of Sarala niryasa taila or Shrivasa taila, the turpentine oil. The rosin, rosin spirit or pinoline and rosin oil 80-85% are obtained. The pine oil (natural) is obtained by steam distillation of pinus woods. Leaves (also from tender leaves and flowers) yield aromatic oil 0.26% and remain material (after extraction) of leaves in pine-wood. Oleoresin yield 20% oil of turpentine which contains pinene, carene, longifolene and other terpenes. Detailed screening of pines and various parts of products have been chemically conducted and ample date available on record, in view of wide and multipurpose utility.

Ethnopharmacological uses:

Pinus roxburghii has been widely used as a traditional remedy by the local tribes in various parts of Northern India. The wood oil is antiseptic, diaphoretic, rubefacient, aromatic and carminative in nature. The bark paste is applied in burns, scalds and ulcers. The timber is largely used for various purposes e.g., matchbox industry, sports goods, musical instruments, house building, furniture, tea chests etc. The volatile component of resin known as turpentine oil is the most important basic raw material for the synthesis of terpene chemicals widely used as adhesives, lubrication, solvents, plasticizers, paints and varnishes, antiseptic and expectorant. It is included in the Indian Pharmaceutical Codex as Oleum terebintinae for treatment of chronic bronchitis. Turpentine oil is applied externally as rubefacient in lumbago and arthritis. It is also used as remedy for neuralgia, minor hemorrhages of tooth sockets and also recommended in gangrene of lungs. Inhaling the vapors of turpentine is useful in bronchitis. Resin (Biroja) is obtained as solid residue in the distillation of turpentine oil from oleoresin. It is used for bangles, varnish, paints, polish industries, ingredient of printing inks, batteries. To heel cracks boiled resin (khaida or leesa) are used. The carbon is collected from the burnt resinous wood of P. roxburghii mixed with mustard oil and is made into a paste (kajal), which is applied inside the lower eyelids to keep the eyes clean and attractive.

Commercial uses

Pinus roxburghii is majorly a timber yielding plant and hence possess high commercial value. The heartwood of the plant is used in the making of furniture and building houses while the softwood is used in packaging cases and tea chest. The bark is rich in tannins and finds its application in tanneries. The resin is commonly used to repair broken ceramic pottery. It is also used in protective coatings, varnishes and printing ink. When destructively distilled, resin produces a viscous liquid called rosin oil which is used as lubricating greases. Turpentine oil is commercially important as it is a major component in varnishes, thinners, sealing wax, soaps and disinfectants.

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Table 3: Pharmacological activities of Pinus roxburghii.

Activity	Parts used	Dose	Methods
Hepatoprotective[44]	Wood oil	(200,300,500) mg/kg	Carbon tetrachloride and ethanol induced hepatotoxicity
Analgesic[45]	Bark	(100,300,500) mg/kg	Acetic acid induced writhing and tail immersion test in Swiss albino rats
Anti-inflammatory[46]	Bark	(100,300,500) mg/kg	Carrageenan induced paw oedema and cotton pellet granuloma in wistar albino rats
Anti-convulsant activity[47]	Bark	(300, 500) mg/kg	Maximal electroshock(MES) and Pentylenetetrazole(PTZ) induced seizures in wistar albino rats .
Antiasthmatic activity[48]	Whole plant	100mg/kg	Histamine induced broncospasm in guinea pig and catalepsy in mice
Antidyslipidemic[49]	Needle	100mg/kg	High fat diet fed hyperlipidaemic golden Syrian hamster
Anticancer[50][51]	Bark Cone oil	(100, 200, 400, 800) μg/ml 100μg/ml	IMR-32 Human neuroblastoma cancer cell line MCF- 7 cells
Antibacterial and antifungal[52][53]	Needles and female cones Bark	5mg/ml (500, 1000, 1500) μg/ml	*E. coli*, *Enterobacter aerogenes*, *Agrobacterium tumefaciens*, *Pseudomonas aurignosa*, *E. coli*, *Staphylococcus aureus*, *Klebsiella pneumonia*, *Candida albicans*
Antidiabetic[54]	Bark	(100,300,500) mg/kg	Alloxan induced diabetic rats

Pharmacological uses

Hepatoprotective Activity

Hepatoprotective activity of wood oil of Pinus roxburghii at doses of 200, 300 and 400 mg/kg on rat liver damage induced by carbon tetrachloride and ethanol. The substantially elevated enzymatic levels of aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase and decreased level of reduced

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glutathione (GSH) and total protein were significantly restored to normal levels.

Analgesic and Anti-inflammatory Activities

Alcoholic extract of Pinus roxburghii bark exhibited anti-inflammatory and analgesic activity at the doses of 100, 300 and 500 mg/kg (analgesic activity was evaluated by acetic acid-induced writhing and tail immersion tests in swiss albino mice. Acute and chronic anti-inflammatory activity was evaluated by carrageenan-induced paw oedema and cotton pellet granuloma in wistar albino rats. These activities were due to the presence of polyphenolic compounds present in the extract.

Anticonvulsant Activity

Alcoholic extract of Pinus roxburghii extract at doses of 100, 300 and 500 mg/kg was effective against generalized tonic-clonic and partial seizures using maximal electroshock induced seizure model in rats.

Antiasthmatic activity

The alcoholic extract of P. roxburghii was evaluated as antiasthmatic using guinea pig ileum preparation (in-vitro), histamine-induced bron- chospasm in guinea pigs and catalepsy in mice (in-vivo). Anti-allergic activity of the plant was evaluated using milk-induced leukocytosis in mice and passive paw anaphylaxis in rats (in-vivo).

Antioxidant and Antidyslipidemic Activities

Pinus roxburghii needle extract possesses significant potential to lower the level of plasma lipid profile followed by a beneficial effect on high density lipoproteins (HDL) in high fat diet fed hyperlipidemic golden Syrian hamster model. Antioxidant activity of n-butanol fraction and alcoholic extract was found to be significant when assessed by trolox equivalent antioxidant capacity (TEAC) assay. Sharma et.al., 2016 described plant extract of Pinus roxburghii bark posses significant anti- oxidant activity against 2,2-diphenyl-1-picrylhydrazyl (DPPH) and nitric oxide assays.

Anticancer activity

Petroleum ether, ethyl acetate, chloroform and ethanol extract of Pinus roxburghii Sarg. was evaluated for anticancer activity on IMR-32 Human Neuroblastoma cancer cell line and implicit the observation that petroleum ether and Chloroform extracts having promising activity. Cone essential oil of P. roxburghii showed notable cytotoxic activity on MCF-7cells at 100 µg/ml.

Antibacterial Activity

The plant extract shows the antimicrobial potential against a wide variety of microorganisms. Antibacterial activity of aerial parts of Pinus roxburghii against E.coli, Enterobacter aerogenes, Agrobac-terium tumefaciens.[] Sharma et. al., 2016 reported significant antimicrobial activity of Pinus roxburghii bark extract against Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus and Candida albicans and promising antifungal activity against Candida albicans[] Aqueous and alcoholic extracts from P. roxburghii stem, leaves, bark, female cone and male cone showed growth-inhibitory activity against the bacterial plant pathogen Agrobacterium tumefaciens.

Antidiabetic activity

Ethanolic extract of Pinus roxburghii bark at dose of 100, 300, 500 mg/kg possesses significant antidiabetic activity in alloxan-induced-diabetic rats.[] In an in-silico study by Kaushik et. al., 2014, it was observed that secoisoresinol, pinoresinol, and cedeodarin showed the best docking results on different diabetic receptors. In another study Kaushik et. al., 2015 showed that the extracts from the bark of Pinus roxburghii by bioassay guided fractionation have good antidiabetic activity when tested through α-amylase inhibitory assay in-vitro.

II. DISCUSSION:

Herbal medicines are considered as a rich source of medicines which can be used in drug development and synthesis. Sarala were reviewed from ancient as well as recent texts.

These herbal medicines play an important role in the development of human culture around the whole world. Herbal medicines have been proved better and even best against allopathic medicines. From the present review it is clear that Pinus roxburghii. have many qualities and features including anti-diabetic, anticancer, anti-bacterial, antifungal and various other and possesses great influence on nervous system. Various studies can be conducted in multiple animal based models for understanding their mechanism of action. The review article focused on new finding on Pinus roxburghii heartwood like macroscopy, microscopy, micrometry and analytical study.

III. CONCLUSION:

Chir pine has lots of unexplored potential and for the improvement in the annual income of the state, a sustainable utilization of this natural resource is exclusively recommended. India, with its great biodiversity, has a tremendous potential and advantage in the emerging field of herbal

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medicine. Plants provide a variety of resources that contribute to the fundamental need of food, clothing and shelter. Plants are utilized as therapeutics agents since time immemorial in both organized (Ayurveda, Unani) and unorganized (folk, tribal, native). From the many years the traditional and ethno-botanical use of natural compounds, specially of plant origin play a important role in treating many of diseases and other area, where natural product is use, as they well tested for their efficacy and generally believed to safe for human use. In the recent year the medicinal importance of the natural product comes in to demand because they obviously deserve scrutiny on modern scientific lines such as phytochemical investigation, biological evaluation on experimental animal models, toxicity studies, investigation of molecular mechanism of action of isolated photo- principles and their clinical trials. The use of herbal drug as a medicinal purpose solve the many of compliance regarding to drug toxicity as compare to synthetic drug, but we cannot refuse to use the synthetic drug due to its specificity. Herbal drug is the best classical approach in the search of new lead molecules for management of various diseases. With the medicinal use of the herbal plant it also uses for the many other general requirements. Medicinal plants help in alleviating human suffering and are widely used for home remedies and trade. Still much research efforts are needed to emphasize on proper degradation of old, dry pine needle which are considered as the most causal agent for forest fire every year. This will be further advantageous for forest regeneration and nutrient recycling. Scientific communications between natives and government organization to rise awareness about the potential of Chir pine will also be beneficial approach. Proper management is also required for the conservation and object- oriented utilization of Chir pine forest. Establishment of small-scale resin and timber based industries nearby of Chir pine forest will be helpful for boosting the economy. This review article helpful for all the Ph.D researcher because all the references are used in this article from API. Nighantu, Samhita text books of Dravya Guna, pharmacognosy and some previous review & research articles.

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