Phytopharmacological Study of Pinus Roxburghii

Tamanna Kumari, Asanjali , Sidharth Pathania, Jyoti Pathania, Sheetal Sharma, Vijay Singh

Corresponding Author – Tamanna Kumari

E.mail – tamannakumari417@gmail.com

Contact no. - 8626945655

Department of Pharmacy, Career Point University, Hamirpur, Himachal Pradesh- 176041India

ABSTRACT

Chirr pine, so named in honor of William Roxburgh, is a species of gymnospermtree in the Pinaceae family, which also has the greatest number of coniferousgenera. It takes this plant between 15 and 30 years to fully mature. With over 110 species worldwide, the Pinaceae family makes up the biggest genus-Pine.Pinus species are valuable forest resources mainly for their timber and gum oleoresins. This review article aims to provide an in-depth analysis of its taxonomy, morphology (it includes description of tree, leaves cone seeds and root system), medicinal use includes traditional use pharmacological effect, phytochemical constituent includes (alkaloid, terpanoids , volatile oil, andflavonoids), this paper elucidates the multifaceted role of chir pine in its native habitat. [3] India is home to the following five native species of pines: P. merkussi (Teriasserian pine), P. roxburghii (Chir pine), P. wallichiana (Bluepine), P. Kesiya (Khasi pine), and P. Gerardiana (Chilgoza pine).

Keywords: Pinus roxburghii ,Phytochemistry , Taxonomy, Morphology, Pharmacological activity

INTRODUCTION

With over 110 species worldwide, the Pinaceae family comprises the biggest genus, Pine.[1] Chirr pine, so named in honor of William Roxburgh, is a species of gymnosperm tree in the Pinaceae family, which also has the greatest number of coniferous genera. It takes this plant between 15 and 30 years to fully mature [2]. Two subgenera make up the genus: Pinus Strobus (Haploxylon, soft pines) and pinus (Diploxylon , hard pines).[3] India is home to the following five native species of pines: P. merkussi (Teriasserian pine), P. roxburghii (Chir pine), P. wallichiana (Blue pine), P. Kesiya (Khasi pine), and P. Gerardiana (Chilgoza pine). P. kesiya and P. merkussi are native to Assam (India) and Burma, whereas P. Wallichiana and P. gerardiana are found in the Himalayas. The distinct climate promotes the cultivation of a wide variety of plants with therapeutic value. Pinus species are valuable forest resources mainly for their timber and gum oleoresins. Pinus roxburghii, Pinus wallichiiana, and Pinus gerardiana are the three Pinus plant speciesthat are most prevalent in Himachal Pradesh.

Pinus roxburghii

Chir pine, or P. roxburghii Sarg, is a tall tree with a spreading crown that ranges in elevation from 450 to 2400 metres (1.49 miles), extending from Kashmir to Bhutan and the Siwalik Hills. P. Wallichina, also known as the blue pine, was discovered between 2000 and 3500 meters above sea level, while P. gerardiana, also known asthe Chilgoza pine, was discovered between 1600 and 3000 meters above sea level in the Himachal Pradesh (H.P.) district of Kinnaur. To completely investigate the scientific foundation for the therapeutic usefulness of this plant and to inform researchers about the potential of Pinus species from the Himalayas, the current review was conducted [4]. Terpenoids, flavonoids, tannins, xanthones, saponins, phenolic chemicals, triterpenes, and steroids are all abundant in pinus plants. Caryophyllene, 3-carene, α-humulne, α-pinene, α-terpeniol, and longifolene were the main phytochemicals isolated from P. roxburghii leaves. Pinus roxbuerghii sarg leaves contain alpha- limonene, alpha-phellandrene, bomeol, and longifolene. Chirr Pine: a member of thefamily. This tree is tall and evergreen, reaching heights of 30 to 50 metres with needles that are 14 to 16 cm long and a trunk diameter of up to 2 mm (about 0.08 in), or 0.08 in. A height of 500 to 2500 m AMSL is where it can be found [5]. It is widely known for its resin output, paper pulp, and timber, and is acknowledged as a commercially significant species. In Indian traditional

medicine, or ayurveda, this plant is widely recognized. It is an oleaginous, warming, aromatic, bittersweet plant that also acts as an intestinal antiseptic. When treating conditions such ulcers, diaphoresis, eye, throat, blood, and skin bronchitis, as well as inflammation and itching, [6]

Pinus gerediana

At medium heights (17 to 27 m) and 2-4 m in dbh, P. gerardiana is commonly referred to as Chilgoza trees. The tiny, horizontal branches have silvery, grey bark and glabrous bark. The dark green leaves are needle-shaped and come in clusters ofthree.[7] Cones from females are spherical and covered in hard, woody scales; however, the male cones are longer. Typically, these cylindrical, deep brown seeds become ripe in October. They have a pointed top. (8)

PINUS WILLICHIANA

The Pinus wallichiana Native to the Hindu Kush Mountains, the Karakoram Range, and the Himalayan Range is the Pinus species known as A.B. Jackson, or blue pine. Starting in Myanmar, China, Bhutan, Nepal, India, Pakistan and spreading through eastern Afghanistan. This plant grows widely and luxuriantly over the Himalayan mountains, with an altitudinal range of 1800-1300 metres. In [9] It is found in locations with high altitude and limited rainfall or low altitude and abundant rainfall.The plant loves to flourish in cold climates. Next in terms of commercial importanceto deodar, Pinus wallichiana is mostly utilised for its timber. In addition to producingexcellent charcoal with a calorific value of 4995, the wood serves as a dependable fuel source.[10] A large amount of furniture, planks, window frames, and interior fixtures are made from this wood. Five Not only is the plant utilised for its lumber, but it is also used to extract oleoresins, which are used to make camphor, needle oil,and turpentine oil. In [11] Mostly situated between 1800 and 4000 metres, it is an elevated pine.Gonorrhoea and stomach disorders are treated with the plant resin in addition to being used as an intoxication. Blisters for suppuration and buboes plasterare applied externally using it. The woody portion of P. wallichiana is beneficial forcough, ulcers, body burning, and fainting.[12]

PINUS KESIYA

Pinus kesiya, often known as Khasi pine, is a rapidly growing, three-needle pine thatis highly

valued for its wood and excellent resin. It is currently only found in small, isolated areas of the Khasi and Naga hills in Shillong and Manipur due to overexploitation over the past several decades. Additionally, Myanmar, Thailand, and the Philippines are among its native habitats.[13] Because the wood it produces is so durable, its excellent grade timber is the reason for its global demand. Asian regions around the Himalayas are home to Pinus kesiya. It thrives in regions from300 to 2700 meters above sea level, including Burma, India, China, Laos, Philippines, Thailand, Tibet, and Vietnam. [14]

PINUS MERKUSII

Pinus merkusii, commonly referred to as Tusam or Sumatran pine, is the only pine that grows naturally in countries south of the equator. These countries include Vietnam, Laos, Cambodia, Indonesia, the Philippines, Myanmar, and Thailand. There are three native strains of Sumatran pine in Indonesia, which makes it a significant species both environmentally and economically [15]. With medium-sized trees that may grow to heights of up to 70 metres, P.merkusii is the tallest pine species in the world. Initially, the canopy of the tree has a pyramid-like shape, but as it gets older, it tends to spread out and become flatter. The only parts of the Indonesian island of Sumatra where P.merkusii is natively found are Aceh, Tapanuli(North Sumatra), and Kerinci. Because it generates latex (gondorukem) faster and in larger numbers than the other two native pines, even before the stem in the latex hasnaturally emerged, Pinus merkusii Kerinci has a great deal of promise. The big, straight trunk of P.merkusii Kerinci makes its wood even better [16].

Table 1: Phytochemical constituent and uses of different species of pinus

Sr. No.	Common name	Scientific name	Phytochemical Constituent	Uses	Reference
1.	Chir pine	P. roxburghii Sarg	Terpenoid, flavonoids, tannins, xanthones saponins,phenolic chemicals, triterpenes, and steroids are all abundant inpinus plants	Intestinal antiseptic, ulcers, diaphoresis, eye, throat, blood, and skin bronchitis, as well as inflammation and itching	4

2.	Chilgozapine	Pinus gerediana	Linoleic acid, Oleic acid, Albumenoids, Oil starch, Polyphenols Phytosterol,	Antithrombatic, antidiabtic, antifungal, Anti-inflamatory	17
3.	Khasi pine	Pinus kesiya	Terpenoids, including α- pinene, Alkaloids, Steroids, Xanthone, Reducing sugar,and Saponin	Medicine	18
4.	Tusamr Sumatran pine	Pinus merkussi	flavonoids, phenols, alkaloids, tannins, and terpenoids	paint solvents, paper, paint oil, perfume blends, detergents, flavorings, insecticides, lubricants, medicines, and plastics	19-20
5.	**B**lue pine	Pinus wallichiana	alkaloids, flavonoids, tannins, phenols, lycopene and carotenoids in hydroalcoholic	Gonorrhoea and stomach disorders are treated with the plant resin used as an intoxication. Blisters cough, ulcers, body burning, and fainting.	12,21

Categorization of **Pinus Roxburghii (according to taxonomy):**

Table 2: Categorization

Taxonomical	**Classification**	**Common names**	**Reference**
Kingdom	Plantae	**English-**pine tree, long livedpine **Sanskrit**-Bhadra Daru,Manojna **Bengali-** Saralgachha	22, 29, 30
Division	Pinophyte		
Class	Pinopsida		
Order	Pinales		
Family	Pinaceae		
Genus	Pinus		

Sub Genes Species	Pinus Pinus Roxburghii	**Hindi-** Chil, Shir, Salla Simaidevadari **Gujrati-** Saraladeodara **Malyalam-** Salla, Charalam	

Geographical distribution and morphologicalproperties of pinus roxburghii

The Pinus roxburghii range stretches from Nepal to Bhutan, as well as to Pakistan (Khyber Pakhtunkhwa and Azad Kashmir) and Northern India (Punjab, Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir). This towering tree with a spreading crown may be found in the Siwalik highlands and the Himalayas, extending from Kashmir to Bhutan. Nonetheless, it thrives in Pakistan, where the mean lowest temperature is between 5 and 15 degrees Celsius, and the elevation is between 1200 and 1850 metres (approximately 1.15 miles).[23] Pines are important economically because they provide non-woody material, such as pine needles, which are 14–16 cm (about 6.3 in) long, as well as woody and lumber material. Pines are also endowed with turpentine oil. Pine needles are an abundant source of alkaloids, vitamin C, tannins, pulp, essential oils, resin, and nuts. [24-26]. Evidence of the antibacterial, diuretic, rubefacient, and vermifuge properties of turpentine derived from the resin of all pines.

Patterns of P. roxburghii morphology

Male flowers are around 1.5 cm (0.59 in) long and organised in cones; female cones are solitary or in groups of two to five, ovoid, 10 to 20 cm (7.87 in) when ripe, brown, woody, and have winged seeds; without wings, they are between 7.5 and 130 mm (5.12 in) and 6.5 mm (0.26 in); their wings are lengthy and membrane-like. A large tree with roughly whorled branches; dark grey, often reddish, deeply fissured, roughbark that exfoliates in longitudinally elongated plates; three-celled leaves that are 20–30 cm (about 11.81 in) long, triquetrous, finely toothed, light green, and persist for an average of 1.5 years.[27] Also known as Chir pine trees measure around 55 metres in length and more than 100 centimeters (about 3.28 ft) in diameter, width, and height. Winter buds are ovoid, tiny, brow, and non-resinous; the bark

is a deep reddish-brown colour that is thick, longitudinal, and scaly. These trees feature needle-shaped leaves with three leaves per bundle that have a flabellate-triangular cross section and a cylindrical form. Cones are 10-15 x 6-9 cm (about 3.54 in), are oval, pedunculate, and short. The seeds have a length of 8 to 12 mm (about 0.47 in),or around 0.47 in, with a long wing that measures 25 cm (about 9.84 in). They usually reach maturity in October or November [28].

Figure1 : Pinus Roxburghii

Traditional uses of Pinus Roxburghii:

Native inhabitants of Uttarakhand pass on their knowledge of traditional remedies, sometimes referred to as indigenous or folk medicine, from generation to generation. This medicinal stock is passed down orally from generation to generation, but there are currently no written records about it. Since the dawn of human civilization, numerous ailments have been treated using these ancient remedies. Resin, needle oil, and seeds are just a few of the beneficial items made from Chir pine that are widelyused to treat many medical conditions.

Table3: Traditional uses of Pinus Roxburghii

Part used	**Traditional use**	**Reference**
Needels	Needel leaves have several uses, including diuretics (which enhanceurine flow), cell erosion prevention, sheltering, and preserving fruits amid creation. Localised leaf ornamentation is also used to cure sprains.	29, 30

Bark	Ulcers, wounds, fissures, and skin disorders are treated with barkpaste and fuel wood.	31
Wood	Wood has several uses such as cooling the body's burning feeling, emollient, fragrant, antibacterial, deodorant, hemostatic, and diuretic. The following are some uses for stimulants: fuel wood, 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 appealing, worm infection, hemoptysis, worm infection, flatulence, liver diseases, bronchitis inflammation, and useful in eye, ear, and pharynx disease, foul ulcers, hemoptysis, andliver diseases.	31,33
Resin	Applying plant resin topically to pimples for two to three hours a day is a common practice. Resin is also used as a base for plaster, as a stimulating application for ulcers and abscesses, as a treatment for snake bites and scorpionsting, and as a blood cleanser. Oleoresin can be used to treat a variety of conditions, including cough, cold, asthma, chronic bronchitis, liver and spleen disease, kidney and bladder problems, gonorrhoea, scurvy, epilepsy, chest problems, skin diseases, and blood purification. Two grammes of resin and an equal amount of common salt are boiled in 250–300 millilitres of water and consumed warm before bedtime for two to four days. Among its many properties, oleoresin is vermifuge, demulcent, expectorant, anodyne, anti-inflammatory, purgative, and rubefacient The use of resin on boils, zits, blisters, and pus production is utilised in steam bath therapy for rheumatic illnesses, heel fractures, enlarge eye area removal Used for cuts and wounds, in shattered ceramic pots.	35, 36

Oil\ terpe ntine oil	In the form of Linimentum Terebinthinae and Linimentum Terebinthinae Actium, turpentine oil is rubefacient in cases of persistent rheumatism	34
Seed	Eating roasted seeds is a great way to get oil and galactagogue.	34

Phytochemical constituents of Pinus Roxburghii:

Volatial Oil

Volatile oil, also referred to as essential oil, was identified in Pinus roxburghi cone oil using a gc-MS study, which detected 78 components and 81 compounds. It was discovered that there were 38 components in bark oil and 68 in needle oil. The primary volatile oils were (E) Caryophyllene, [α-humulene], and the monoterpene alcohols terpinene-4-ol and [α terpineol]. Only cone and needles contain the monoterpene carene. Other essential oils found in Pinus roxburghi include α-thujene, α-phellandrene-8-ol, veratrole, pinocarvone, terpinen-4-ol, n-Octanol, linalool, nonanal, p-cymen-8-ol, linalool propanate, eugenol, and isoberneol.[37]

Alkaloids

Amino acids found in plant leaves, stems, bark, fruits, and cones are the source of alkaloids. These are compounds made of nitrogen. Analgesic, stimulant, anti- malarial, anticancerous, neuroprotective, cardio protective, anti-inflammatory, antiparasitic, antidiabetic, vasorelaxant, and antibacterial properties are only a few of the therapeutic properties of alkaloids. Because alkaloids are efficient against alzhimer, they have neuroprotective properties. A few common amino acids— tyrosine, ornithine, or Argentine—lysine, and tryptophan—are the source of them.[38] Alkaloids have the capacity to defend against Alzheimer's disease, Huntington's disease. multiple sclerosis, and Parkinson's disease, [39]

FLAVONOIDS

Because glycosides are so reliant on sugar moiety, they can be found in plants in a variety of combinations. However, P. roxburghii's ethyl acetate and dichloromethane fractions had the

highest number of flavonoids as aglycone of the two barks. Based on their structural differences, they are further separated into flavanols, flavones, flavanonols, flavanones, isoflavones, and anthocyanidins.[40] The vibrant hues of flowers, fruits, and berries that contribute to the beauty of the biosphere are largely attributed to flavonoids. besides their impacts on biology, nutrition, and medicine.[41] Numerous phenolic components, such as flavonoids, have been investigated for their potent anti-inflammatory, antioxidant, anticancerr antibacterial,skin UV protection, cardioprotective, and other medicinal uses.[42]

Terpanoids

Beta-carotene, the most active component of carotene, has antioxidant properties. Without changing back into vitamin, A, alpha, beta, and gamma carotenes which include lutein and lycopene protect against cardiovascular and malignant disorders.[43] Bicyclic sesquiterpene caryophyllene has been shown to possess neuroprotective, antidepressant, antinociceptive, and anti-inflammatory qualities. Another secondary metabolite is beta-carotene, which is a member of the unoxidizedchemical group of carotenoids. Due to its antioxidant qualities and significance as aprecursor to vitamin A, it aids in the fight against cancer as well as other illnesses. Strong fungicidal, antibacterial, and biocidal qualities have all been documented for thymol [44], from monoterpenoids to sesquiterpenoids to diterpenoids to polyterpenoids. Among the monoterpenoids are borneol, thymol, myrcene, limonene, pinene, geraniol, and terpineol. The main active component of tea tree oil is thought to be 4-terpineol, which has been shown in earlier research to have antibacterial, anti-inflammatory, and antifungal properties [45].

Pharmacological activites of pinus roxburghii:

Anti - bacterial

Plant component extracts from P. roxburghii have antibacterial action against a rangeof pathogenic bacteria, both plant and human. It has been shown that almost all plant

component extracts can prevent the development of A. tumefaciens. When it came to the inhibitory action against E. coli, it was discovered that every other extract— aside from stem extracts—showed inhibitions. Extracts made from alcohol from leaves and female cones were shown to be efficient against the development of S. arizonae, but no other extracts demonstrated inhibition against the invasive species.The stem's aqueous extract was the only one that inhibited S. typhi growth. Except for the alcoholic bark extract and the aqueous and alcoholic male cone extracts, every extract has shown an inhibitory effect on the development of S. aureus. Strong antibacterial chemicals with significant antibiotic potential are present [54]. According to these findings, P. roxburghii female cones, as opposed to needles, mayhave more antibacterial action against X. oryzae. Stereo-configuration, however, is a repeatable and sensitive method for assessing antibacterial ability. When it comesto antibacterial action against Pseudomonas alcaligenes once higher, the female cones of P.roxburghii have more antifungal activity than the needles. The P. roxburghii female cones extract in methanol showed the highest reading of all the Pinus cone and needle extracts, with a zone of inhibition of 22±2a. [55]

Antiseptic

Native communities in several regions of Northern India have long utilized Pinus roxburghii as a traditional medicine. The properties of the oil extracted from wood of pinus tree include rubefacient, fragrant, carminative properties antibacterial, and diaphoretic, properties. This property is used to treat illnesses of the nerves and as an expectorant and nerve tonic and as a treatment for skin, worm infestations, hemorrhage's, ear, and eye disorders. The bark paste is used for ulcers, burns, and scalds [56].

Antimicrobial

Methyl trans-7-oxodeisopropyldehydroabietate (MTOD), Methyl cis-7-oxodeisopropyldehydroabietate (MCOD) resin acid derivatives derived from p resin of pine tree, were evaluated for their antibacterial activity using a technique carried out in solid medium in multiwell plates. The growth of S. aureus and E. faecalis bacteria as well as the spore germination of Syncephalastrum racemosum, filamentous fungus Mucor racemosus, and R.arrhizus , Rhizopus stolonifer, were all either totally or partially suppressed by MCOD and MTOD. Escherichia coli and Klebsiella pneumoniae growth was suppressed by the

combination of both drugs.[57]

Antimalerial

The biological activity of oxide ethers of carbonyl compounds derived from longifolene, a sesquiterpene isolated from P. longifolia, was evaluated against the Culex quinquefasciatus mosquito in order to determine P. roxburghii's anti-mosquito properties. All oxime ethers had 90–100% mortality due to insect growth regulating (IGR) activity at 1 ppm; however, certain oxime ethers showed 80–85%M action at 0.1 ppm. [58]

Antioxidant

Utilizing the phosphomolybdenum method, the extracts' total antioxidant activity was evaluated. 0.3 ml (about 0.01 oz) of the extract was combined with 3 ml (about

0.1 oz) of the reagent solution (0.6 M sulfuric acid, 28 mm (about 1.1 in) sodium phosphate, and 4 mM ammonium molybdate). The reaction mixture was sealed and then incubated at 95 °C for 90 minutes (about 1 and a half hours), or around 1.5 hours. Once the sample had cooled to room temperature, the absorbance was measured at 695 nm against a blank (0.3 ml (about 0.01 oz) of methanol). Ascorbic acid was considered the benchmark. [59] a cholesterol level through the beneficial effects of high-density lipoprotein.

Anti-tumar

The A549 human lung cancer cell line was tested for the anti-cancer activity of compound (A) gallic acid derived from P. roxburghii. The drug concentration increased, indicating excellent action at the maximum drug concentration of 80µg/ml. A chemical is considered considerably active, as per the SRB test technique, if the expected value falls under the 80 limits. When tested against the A549 human lung cancer cell line, the isolated component (B) catechin from P. roxburghii shown anti-cancer activity. The catechin's findings ranged from 92.9 to 98.9, with a very little inclination in a graph at the maximal concentration level of 80 µg/ml. Even if the drug's concentration was increased, this suggests little action. It may be concluded, then, that catechin has little effects on the human lung cancer cell line A549. LC50: The medication concentration that results in a 50% cell death. GI50:. In the case of extracts, GI50 value ≤ 20µg/ml is deemed indicative of activity. TGI (Total Growth Inhibition): Total growth inhibition brought on by the drug's concentration. Adriamycin, or positive control agent, is an

ADR. [60]

Antihypersenstion

Quercetin, which is rich in the bark extract and needles of P. roxburghii and P. wallichiana, has been observed to have antihypertensive characteristics. [43]

Wound healing

Using excision and incision wound models in Wistar albino rats, the wound-healingproperties of methanol and aqueous extracts of P. longifolia leaves were tested. There was notable wound-healing efficacy in both extracts. The methanol extract groups, however, saw quicker rates of wound shrinkage and epithelization [61].

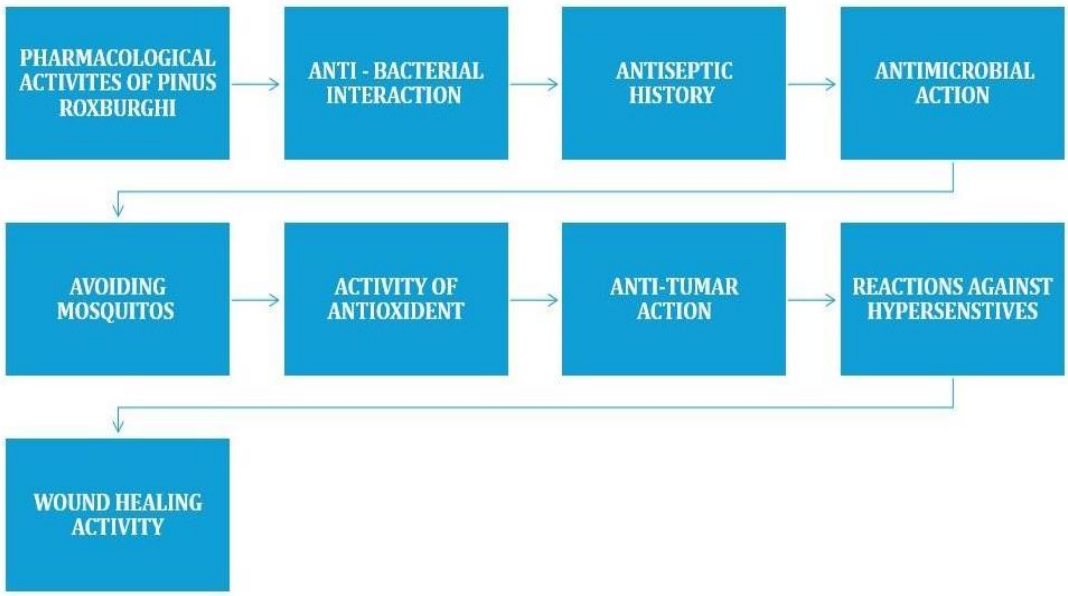

Figure 2: Pharmacological activity

APPLICATION OF PINUS ROXBURGHII SARG

- It is added to several lubricating compositions, hair fixing, and nail polishing preparations, as well as used in the production of explosives, insecticides, and disinfectants [62].
- It is a common ingredient in various items including chewing gum, polishes, and varnishes, in the creation of ointments and plasters.
- Boils are cured by applying the resin.[63]
- Adhesives, printing ink, electric isolation, paper, varnish, soldering flux, and matches can all benefit from the usage of rosin.
- Rosin provides features including adhesiveness, hardness, smoothness on the surface, and antiblocking to the printing ink business. Since rosin has strongelectrical isolation, high voltage electrical wires utilise it as an oil. Rosin is used during the soldering process to remove oxide compounds from the surface of chewing gum, synthetic rubber, and metal [64].
- Due to its anti-inflammatory qualities, pine resin has been utilised by Native Americans to cure rheumatism.
- Pine resin has long been used externally as a burn and sore therapy. Diuretic, laxative, and stimulating qualities are found in pine resin.
- As an antiseptic, diaphoretic, diuretic, rubefacient, stimulant, and febrifuge, various plant components are used to treat cough, colds, influenza, TB, and bronchitis [65, 66].
- The effects of gum therapy on uterine and vaginal illnesses have been demonstrated [67].
- Because Pinus roxburghii is primarily a timber-producing plant, it has a high market value. The plant's heartwood is used to make furniture and to build houses, while the softwood is utilised to make tea chests and packing cases.[68]

- Since turpentine oil is a key ingredient in varnishes, thinners, sealing wax, soaps, and disinfectants, it has significant commercial value.[69]

- Oleum terebintinae, a medication for treating chronic bronchitis, is included in the Indian Pharmaceutical Codex. [70]

- P. roxburghii is combined with mustard oil to create a paste (kajal), which is then put inside the lower eyelids to maintain tidy and appealing eyes.[71]

Conflict of Interest

There is no Conflict of Interest.

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