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Reveiew Article

Phytoconstituents and Pharmacological activity of *Pinus roxburghii*- Sarg.:A Review

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Abstract

The *Pinus roxburghii* Sarg (Pinaceae) is commonly known as chir pine. The taxonomy of *P.roxburghii* is Kingdom: plantae, division: pinophyta, class: pinopsida, family: pinaceae, genius: pinus, species: roxburghii.The *Pinus roxburghii* is an economically valuable species,it is also planted in the garden for ornamental purpose. The Plant is employed in paper and rubber industries and also the source of an oleoresin, which yields turpentine oil. Traditional uses of Plant is sweet, bitter, pungent, intestinal antiseptic, antidyslipidemic and antioxidant and is used in eye, ear, throat, blood , skin, bronchitis, ulcer, inflammations and itching .The timber of the tree is largely used for various purposes e.g. house building and musical instruments. Phytochemicals present in Pinus needles and stems are vitamin C, tannins, flavonoids and alkaloids, essential oil obtained from Needle, bark, and cone of tree α-pinene, β-pinene, car-3-ene, abietic acid and isopimaric acid was isolated from xylem resin. Pharmacological activity of wood oil is used for hepatoprotective. Resins is used as antibacterial, leaves having wound healing and analgesic activity, bark having anticonvulsant. Cone is used in treatment of fungal infection.

Keywords: *Pinus roxburghii*,cytotoxicity, Pharmacological activities,phytochemical constituents

Introduction

The *Pinus roxburghii* Sarg (Pinaceae) is commonly known as chir pine. It is a large tree up to 28-55 m in height with a trunk diameter reaching up to 2 m, the cones are ovoid conic and usually open up to 20 cm to release the seeds[1]. The bark is red-brown, leaves are needle-like, in fascicles of three, very slender, distinctly yellowish green. The*P. roxburghii* is an economically valuable species, balancing the ecosystem of the Indian mountains. It is also planted in the garden for ornamental purpose. The rosin is valuable in adhesives, printing ink, electric isolation, and paper, patching flux, varnish and matches. In printing ink industry rosin gives adhesiveness, surface smoothness, hardness, antiblocking what's more, different properties. Rosin has a decent electric segregation, being utilized as oil in links for high voltage power. In fastening process, rosin is utilized to dispose of oxide mixes in the surface of metal, engineered elastic and biting gums[2]. Local Americans have utilized pine sap to treat stiffness in view of its mitigating properties. The sap demonstrations to evacuate the joint aggravation caused by ailment, which makes a difference to reestablish development and to reduce torment. The Constantan Indians picked up these advantages by biting on the gum-like tar. A customary utilize for pine pitch has been as an outside treatment for consumes and bruises. The pine sap has stimulant diuretic and purgative properties[3].
Different parts of the plant are recommended to treat hack, colds, flu, tuberculosis, bronchitis, as sterile, diaphoretic, diuretic, rubefacient, stimulant and febrifuge[4].

DISTRIBUTION

A tall tree with a spreading crown is found in the Himalayas from Kashmir to Bhutan and in the Siwalik slopes at heights of 450-2,400 m. It comes up decently well in the fields likewise and is in some cases planted in gardens for elaborate purposes. The chir pine happens in the Himalayas exclusively in the external slopes and valleys, which get the greater part of the precipitation amid the monsoon[5].

CULTIVATION

There are two types of Cultivation

Natural Regeneration

It takes puts through seeds. Under standard woodland conditions, trees under 30-year old sometimes bear cones. The cones start to open amid April-May of the third year, i.e., around 24 months after their appearance and the seeds get scattered amid April-July. Under regular conditions, the seeds develop when adequate dampness is accessible. The germination initiates toward the start of the storm. A number of components, for example, light, dry spell, tonography and soil have impressive impact upon the degree and nature of regular recovery[6].

Artificial Regeneration

It is required transplanting nursery-raised seedlings or by coordinate sowing. The develop cones are gathered from the trees amid March-April what's more, are put in the hot sun to relax the scales, what's more, from that point the seeds are sifted out. The seeds are sown in the nursery amid March-April in shallow drills 15 cm separated. The seedlings are chosen in July. Maybe a couple year old seedlings are normally transplanted toward the start of the downpours[7].

VERNACULAR NAMES

The vernacular names of *P. roxburghii* are Bhadradaru, Manojna in Sanskrit; Chil, Chir,Salla in Hindi; Saralgachha in Bengali;Saraladeodara in Gujarati; Salla, Charalam inMalayalam; Simaidevadari in Tamil and Devadaru in Telugu[8].

Taxonomyof Pinus *roxburghii*

Kingdom	:	*Plantae*
Division	:	*Pinophyta*
Class	:	*Pinopsida*
Family	:	*Pinaceae*
Genus	:	*Pinus*
Species	:	*Roxburghii*
Common name	:	*Chir*

Fig-1 *Pinus roxburghii* tree

MORPHOLOGY

Roots

P. roxburghii having the branches with restricted growth and relatively short life called the short or dwarf roots. Some of their root branch dichotomously, have an ectotrophic mycorrhiza and are termed as mycorrhizal roots[9].

Leaves

They are also known as needles. Adult leaves are 20-30 cm long, they are triquetrous, long, narrow (acicular), tough and light green persisting on an average for a year and a half. The foliage leaves which appears only on the dwarf shoot. They are of smooth surface and borne on dwarf shoots in fascicles of 2-5. The needles are straight on young shoots but spread outwards or drop down in older shoots. The scale leaves are brown membraneous, protective in function found on dwarf shoots[10-11].

(Fig. 2A)

Bark

Occurs as a typically layers of scaly flakes, thick, cracked, brown in color and scented by the resin. Some pine tree species have a thin flaky bark, when on close observation chunks of bark can be seen just hanging on or flaking off. Thickness of bark varies; it is about 0.2 inch in young saplings to an average of about 2 inches in mature trees[10].(Fig. 2B)

Flowers

Male flowers are about 1.5 cm long and arranged in the form of cones. They are produced in clusters. These are generally born on the lower branches of the tree. Each male cone is composed of spirally arranged leaf-like structures called scales or microsporophylls[10-11]. The female flowers are much larger than the male cones. These are usually found on the upper branches. Each female cone is also made of spirally arranged scales which are called megasporophylls. Female cones are solitary or 2-5 together. They are ovoid in shape having size 10-20×7.5×13 cm[10-11].(Fig. 2C and D)

Seeds

The seeds are with a wing and are wind-dispersed. Without wing they are of 7.5-130 ×5×6.5 mm size [10]. (Fig. 2E)

Stem

The main stem erects woody and covered with rugged scaly bark which peels off. The dwarf shoots with limited growth .The dwarf shoots are also called short shoots, brachyblast or foliar spurs, are borne on long shoots and arise in the axil of scale leaves. Each dwarf shoot bears two opposite scaly leaves, called propphyls followed by 4-13, spirally arranged scaly cataphylls. The needle number is three in *P. roxburghii*[10]. (Fig. 2F)

CHEMICAL CONSTITUENTS

P. roxburghii contains a variety of phytoconstituents such as vitamin C, tannins, and alkaloids. Study of essential oils from needle, bark, and cone of *P. roxburghii* reveals the presence a total of 117 components, out of which 111 were, identified[1]. α-pinene, β-pinene, car-3-ene, abietic acid and iso-pimaric acid was isolated from xylem resin[12](fig. 3). Two new xanthone identified as 1, 5-dihydroxy-3,6,7-trimethoxy-8-dimethylallyloxy-xanthone and 1-hydroxy-3,6-dimethoxy-2-β-

Dglucopyranoxanthone have been isolated from the methanol extract of the bark of *P. roxburghii*[13]. The bark is reported to contain 7-10 % of tannins, α-limonene, α-phellandrene, borneol, longifolene and α-cadinene[10](fig. 3). The hydrolyzed fraction of chir pine oleoresin was found to contain two phenolic (ferulic acid, *p*-coumaric) acids and a lignin (pinoresinol). The structure of chemical constituents present inFig. 3like (1) Borneol (2) a-pinine (3) b- pinene (4) eugenol (5) abietic acid (6) longifolene (7) isopimaric acid (8) neral (9) α-Humulene (10) Car-3--ene (11) linalol (12) α-terpinene (13) geraniol[14].

TRADITIONAL USES

The timber of the tree is largely used for various purposes such as house building, furniture, tea chests, sport goods and musical instruments etc.[16] it is also tapped commercially for resin. On distillation, the resin yields an essential oil commonly known as turpentine. The turpentine is chiefly used as a solvent in pharmaceutical preparations, perfume industry, in manufacture of synthetic pine oil, disinfectants, insecticides and denaturants[17]. In traditional system of medicine different parts of the plant have been used for cough, cold, influenza, tuberculosis, bronchitis antiseptic, diaphoretic, diuretic, rubefacient, stimulant and vermifuge. Bark paste is used in burns and scalds. Resin is used to relieve cough and gastric troubles. Plant is used as intestinal antiseptic, hypolipidimic, antioxidant and is used in the treatment of eyes, ears, throat, blood, skin, bronchitis, diaphoresis, ulcer, inflammations and itching[18].

Gum is used as purgative, carminative, emmenagogue, expectorant, aphrodisiac, fattening, diuretic, anthelmintic, analgesic and is used in the treatment of vegina, uterus and eyes. Also good in dyspepsia, ulcer, diaphoresis, scabies, asthma, chronic bronchitis, ozoena, piles, diseases of liver (hepatoprotective), spleen, gleet, ear discharge, toothache, lumbago and tuberculous glands. Resin is used as a remedy for gonorrhea and its plaster is applied to buboos and abscesses for suppuration. Wood is stimulant, diaphoretic used in cough, fainting and ulceration[19].

PHARMACOLOGICAL ACTIVITIES OF *P. ROXBURGHII*

P. roxburghii has a long history of numerous tradi-

tional and ethnobotanical applications in diverse cultures[17]. Various activities that are reported on *P. roxburghii* are summarized in table no.2

- ***Antibacterial activity of P. roxburghii***
  The stereo-design of the particle appears to assume a part in the antibacterial action of these mixes and a conceivable synergistic impact appears to expand their anti-infection action. The procedure depicted in the work appeared to be reproducible and delicate in the assessment of antimicrobial movement towards organisms and microorganisms[25].
- ***Spasmolytic action ofP. Roxburghii***
  Pharmacological tests have shown a frail cardiovascular and spasmolytic activity of the abietic acid[26].
- ***Anti-mosquito activity of P. roxburghii***
  Oxime ethers of carbonyl mixes determined from longifolene, a sesquiterpene acquired from *P. longifolia* were assessed for natural movement against mosquito Culex quinquefasciatus. All oxime ethers showed 90-100 % mortality because of creepy crawly development directing (IGR) action at 1 ppm; some oxime ethers were dynamic at 0.1 ppm demonstrating 80-85 % mortality[27].
- ***Wound healing activity of P. roxburghii***
  Methanol and fluid concentrates of the leaves of P. longifolia were screened for wound recuperating property on extraction, entry point wound models inWistar pale skinned person rats. Both the concentrate appeared critical injury mending action. In any case, the rate of wound withdrawal and epitheliazation was quicker in methanol separate gatherings[28].
- ***Cytotoxicity activity of P. roxburghii***
  Mixes methyl-7-oxodehydro-abietate and methyl-7α-hydroxydehydroabietate, oxidation results of abietic corrosive and its methyl esters were respected strong allergens. The cytotoxicity of a few mixes against KB cells is assessed what's more, frail cytotoxicity action is watched for methyl-7α,13α-dihydroxyabiet-8(14)-enoate, methyl-12-oxoabietate, methyl-7α- hydroxydehydro-abietate and with IC50 estimations of 12.5, 4.5, and 5.8 µg/ml, individually[29].

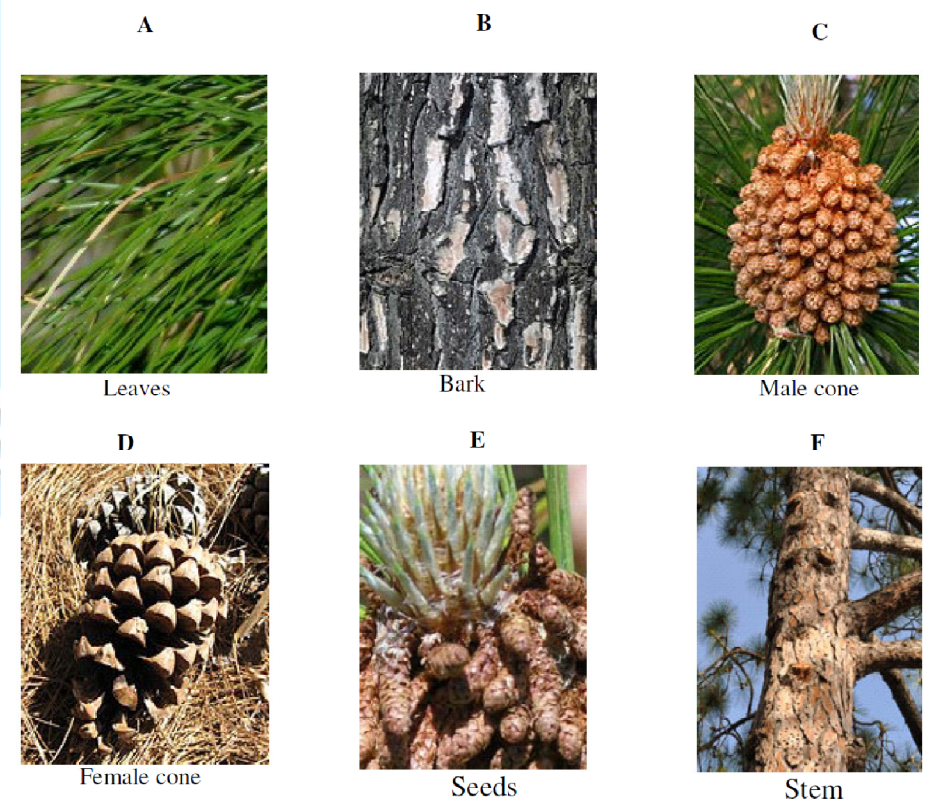

Figure No.2: Partsof *Pinus roxburghii* tree

Table No.1: Chemical compounds in different parts of *P. roxburghii*[1, 12]

Compound	Leaves	Bark	Cone	Xylem resin
Terpenolene	√	√	√	-
Linalol	√	√	√	-
trans-Sabinene hydrate	√	-	√	-
isopimaric acid	-	-	-	√
Phenylethyl alcohol	-	-	√	-
Pincarvone	-	-	√	-
Longifolene	-	√	√	√
Terpinen-4-ol	√	√	√	-
α-Terpineol	√	√	√	-
cis-Piperitol	√	-	-	-
Ceryl alcohol		√		-
β-Pinene	-	-	√	√
α-Pinene	√	-	√	√
Sabinene	√	-	√	-
Myrcene	√	-	√	-
Car-3—ene	√	-	√	√
α-terpinene	√	-	√	-
γ-terpinene	√	-	√	-
Neral	-	√	-	-
Geraniol	√	√	-	-
Eugenol	-	√	-	-
Methyl eugenol	√	√	√	-
α-Humulene	√	√	√	-
α-Amorphene	-	√	-	-
Cembrebe	√	-	-	-
Abietic acid	√	√	√	√

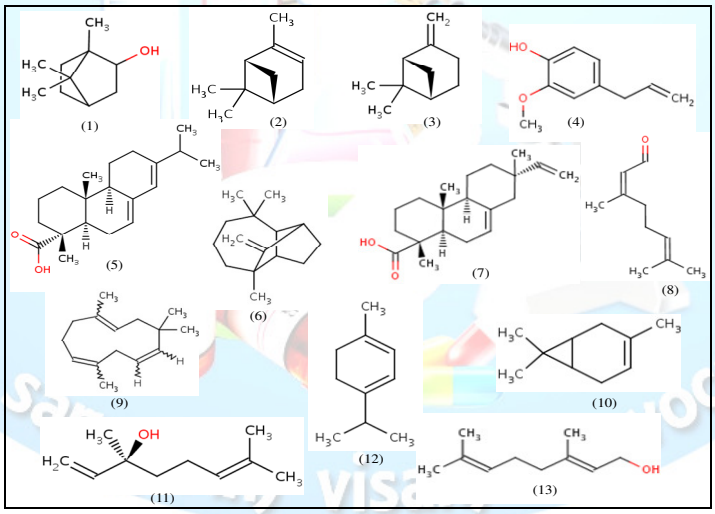

Figure No.3: Some chemical constituents reported in *P. roxburghii;* Borneol (2) a-pinine (3) b- pinene (4) eugenol (5) abietic acid (6) longifolene (7) isopimaric acid (8) neral (9) α-Humulene (10) Car-3--ene (11) linalol (12) α-terpinene (13) geraniol

Table No.2: Pharmacological activities of *Pinus roxburghii*

Part of *P. roxburghii*	Activity	Reference
Wood oil	Hepatoprotective	**12**
Resin	Antibacterial	**20**
Female cone	Antibacterial	**21**
Leaves (Needles)	Antidyslipidemic	**22**
	Antioxidant	**22**
	Wound healing	**23**
	Analgesic	**24**
	Antibacterial	**21**
	Anti-Inflammatory	**24**
	In-vitro cytotoxicity	**1**
Needle oil	Anti-fungal	**1**
Bark	Anticonvulsant	**24**
	In-vitro cytotoxicity	**1**
	Antibacterial	**21**
Cone oil	Anti-fungal	**1**

Analgesic and anti-inflammatory activity

Pain relieving and calming movement of liquor concentrates of P. roxburghii bark has been appeared in exploratory creature models (pain relieving action was assessed by acidic corrosive actuated writhing and tail drenching tests in Swiss pale skinned person mice; intense and interminable mitigating movement was assessed via carrageenan-incited paw oedema and cotton pellet granuloma in Wistar pale skinned person rats) at the measurements of 100, 300 and 500 mg/kg body weight[24].

Antidyslipidemic and antioxidant activity

The needles of P. roxburghii were examined for antidyslipidemic action in high-fat eating regimen bolstered hyperlipidemic brilliant Syrian hamsters. Cancer prevention agent movement of needles was surveyed by trolox proportionate cancer prevention agent limit test, also, movement was observed to be noteworthy in the alcoholic extricate and also in the n-butanol insoluble portions[30]. The antioxidant activity of bark and needle extricates was assessed, who found that the polar division of both parts showedsignificant antioxidant activity[31].

CONCLUSIONS

Plants give a variety of social assets that traverse the key requirements of sustenance, garments drug and safe house. Home grown mixes have been used therapeutically since some time recently written history in both sorted out (Ayurveda, Unani) and disorderly (society, tribal, indigenous) medicinal traditions. Thepharmacological activities of P. roxburghii has a long history of numerous curing many disease like Cytotoxicity, wound healing activity, Spasmolytic action, Analgesic and anti-inflammatory activity etc. The significance of plants in ethnomedicincinal rehearses gives intimations to new range of research furthermore, in biodiversity preservation.

REFERENCES

1. Satyal, P., Paudel, P., Raut, J., Deo, A., Dosoky, N.S. and. Setzer, W.N., 2013. Volatile constituents of *Pinus roxburghii* from Nepal. Pharmacognosy Research.**5 (1)**, 43–48.
2. Wiyono, B., Tachibana, S., Tinambunan D.,2006.Chemical compositions of pine resins, rosin and turpentine oil from West Java, J Forest Res.3(1), 7-17.
3. Langenheim, LH., 2003.Plant resins: chemistry, evaluation, ecology and ethnobotany, Timberpress, Auckland, New Zealand, 453-54.
4. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plant, CSIR, New Delhi, 1986.
5. Anonymous, The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products, Raw Materials, CSIR, Publications and Information Directorate (PID), New Delhi, 8,64-82 (2008)

6. Khare C. Indian Herbal Remedies: Rational Western Therapy, Ayurvedic and other traditional Usage Botany. Berlin, New York: Springer; 2004.
7. The Wealth of India: A dictionary of Indian raw materials and industrial products. New Delhi: Council of Scientific and Industrial Research.69-83(1985)
8. Kirtikar KR, Basu BD. Indian Medicinal Plants,2nd Ed., International Book Distributors,Dehradun.2385-88 (1999)
9. Reus, V.I. Mental disorders. In *Harrison's principles of internal medicine.* 16th ed. p 2547-2551. Mcgraw-Hill companies, USA. (2005).
10. Shuaib, M., Ali, M., Ahamad, J., Naquvi, K.J. and Ahmad.M.I. 2013.Pharmacognosy of *Pinus roxburghii*: A Review.Journal of Pharmacognosy and Phytochemistry.2 (1): 262-268.
11. Biology-notes. (2013). Cited on 9-Jun-13 at 5:17 PM [URL- http://biology-notes.com/bryophytes-and-tracheophytes-2/].
12. Khan, I., Singh, V. and Chaudhary, A.K. 2012. Hepatoprotective activity of Pinus roxburghii Sarg. Wood oil against carbon tetrachloride and ethanol induced hepatotoxicity. Bangladesh Journal of Pharmacology.**7**, 94-99.
13. Rawat, U., Srivastava, B., Semwal, S. and Sati, O.P. 2006. Xanthones from *Pinus roxburghii.* Journal of Indian Chemical Society.83 (4), 391-392.
14. EL-Shaer, NS., 2002. Lignan and Phenolic acids from oleoresin of *Pinus roxburghii* (Chir pine). Alexandria Journal Pharmaceutical Sciences.16 (1), 31-35.
15. (www.ebi.ac.uk/chebi/init.do)
16. Chaturvedi, S., Dass, S., 2011. Traditional Medicinal and Economic uses of Gymnosperms. Bulletin of Environment, Pharmacology and Life Sciences.1 (1), 70-72.
17. Kunwar, RM., Uprety, Y., Burla, K., Chowdhary, CL., Bussmann, RW., 2009. Indigenous use and ethanopharmacology of medicinal plants in west Nepal. Ethnobotany research and applications.**7**, 5-28.
18. Abbasi, AM., Khan, MA., Ahmad, M., Jahn, S.,2010. Ethnopharmacological applications of medicinal plants (*Pinus roxburghii*) to care skin diseases. Journal of Ethnopharmacology.128, 322-335.
19. Shah, R. 2006. Description of *Pinus roxburghii* Sarg. Nature's Medicinal Plants of Uttaranchal.1, 18-19.
20. Savluchinske, FS., Roseiro, JC., Gigante, B.,Marcelo-Curto, MJ., 1997. Method on multiwall plates for the evaluation of the antimicrobial activity of resin acid derivatives. Journal of Microbiological Methods. 28,201-206.
21. Bissa, S., Bohra, A., Bohra, A., 2008. Antibacterial potential of three naked- seeded (Gymnosperm) plants. Natural Product Radiance. 7,420-425.
22. Anju, P., Srivastava, AK., Singhal, B., Mishra, SK., Srivastava, S., & Lakshmi, V., 2011.Antidyslipidemic and Antioxidant Activity of Pinus Roxberghii Needles.Medicinal Chemistry Research.20 (9), 1589-1593.
23. Khandelwal, K.R. Preliminary Phytochemical Screening in Practical Pharmacognosy.Niralli Parkashan, Pune.149-156, (2004).
24. Kaushik, D., Kumar, A., Kaushik, P.Rana, AC., 2012. Anticonvulsant activity of alcoholic extract of bark of Pinus roxburghii Sarg. Journal of Chinese Integrative Medicine.10 (9), 1060-1065.
25. Savluchinske Feio, S., Roseiro JC, Gigante B., Marcelo-Curto, MJ.,1997. Method on multiwallplates for the evaluation of the antimicrobial activity of resin acid derivatives. J Microbiol Meth.28, 201-6.
26. Olechnowicz-Stepien, W., Lamer-Zarawska, E., 1981.Searching for biologically active substances in Pine rosin. Herb Polon. 27(2), 145-52.
27. Sawaikar DD., Sinha B, Hebbalkar GD., 1995. Products active on mosquitoes: part VII-Synthesis and biological activity of logifolene derivatives. Indian J Chem. 34(9), 832-35.
28. Kinger, HK., Dutt, KR., Saini, V., Sheeja, E., Gupta, VB,,Deb, L., 2006. Wound healing activity of *Pinus longifolia* Roxb. Plant Arch.6 (2), 651-52.
29. Prinz, S., Mullner, U., Heilmann, J., Winkelmann K.,Has linger E., Hufner A., 2002.Oxidation products of abietic acid and its methyl ester. J Nat Prod.65 (11), 1530-34.
30. Siddiqui,MF., Ahmed, M., Wahab, M., Khan N., Khan, MU,,Nazim K., Hussain, SS.,2009. Phytosociology of *Pinus roxburghii*Sargent (Chir pine) in lesser Himalayan and Hinduku-

shrange of Pakistan. Pak J Bot.41 (5), 2357-2359.

31. Maimoona,A., Naeem, I., Shujaat, S., Saddiqe, Z., Mughal, T.,Mehmood, T., 2011. Comparison of radical scavenging capacity of different extracts of bark and needles of *Pinus roxburghi*and *Pinus wallichiana*. Asian J Chem.23 (2), 819-822.