



सत्यमेव जयते
Department of Science
and Technology (DST)
Govt. of India

PINUS GERARDIANA WALL.

(CHILGOZA PINE):

AN IMPORTANT CONIFER OF WESTERN HIMALAYA



**HIMACHAL PRADESH COUNCIL FOR SCIENCE
TECHNOLOGY & ENVIRONMENT [HIMCOSTE]**



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ABOUT THE SPECIES:

Pinus gerardiana Wall. commonly known as Chilgoza Pine is one of the 29 important edible nut yielding Pine species found all over the world. It is the only conifer in India which bears highly nutritious edible nuts. It is one of the indigenous and socio-economically important conifer of inner drier regions of Himachal Pradesh. It is a small to medium sized evergreen pine tree, 10-20m tall with compact appearance having short and horizontal branches with usually deep, wide and open crowns with long, erect branches.

It belongs to the family Pinaceae. It is also known as “Champion of the Rocky Mountains” because it grows on inaccessible and difficult site conditions which commonly prevail in inner drier tracts of Western Himalayan region. Chilgoza Pine was first discovered by British Army Officer 'Captain Patrick Gerard' in the year 1832 in India. It is a very slow growing tree and its average life span is 150-200 years. It is the only pine which has immense importance among the local tribal communities because they harvest its seeds/nuts for earning their livelihood. It also forms an important part of their diet and is used for meeting various social obligations.

It grows in association with *Cedrus deodara*, *Quercus ilex*, *Fraxinus xanthoxyloides*, *Olea cuspidata* and *Celtis australis*. It is commonly known as Chilgoza or Neoza in Hindi, Ree in Kinnaur, Miri in Chamba and Chiri or Galboza, Kashti in Kashmir

and Chilgoza/Jhalgoza in Afghanistan. Its distribution is very sparse in the world, confined only to mountains of eastern Afghanistan & Pakistan with scattered appearance in North-Western Himalayas. In Himachal Pradesh, it is mainly distributed in Kinnaur district and small patches have also been recorded in Pangi and Bharmour parts of Chamba district. It is found in inner dry tracts of temperate zones of North-Western Himalayas growing at elevations between 1800m to 3000m above msl. The forests in this area are grouped under Himalayan Dry Temperate Forests (Group 13) of the Forest Types of India (Champion and Seth, 1968).



Chilgoza Pine



Cone Bearing Branches

Natural regeneration of Chilgoza Pine is very low due to many biotic and abiotic factors. The local right holders lop each and every cone from the tree for extracting Neoza nuts. This coupled with incidence of grazing and extraction of timber and resinous torchwood have made this important species an endangered conifer of the Himalayas.

The edible nuts possess carminative, stimulant and expectorant properties. Chilgoza nut contains carbohydrates (21.6 %), proteins (15.9 %), fats(49.9%), moisture content (7.5 %), fibre (2.2 %) and mineral matter (2.90 %). It is one of the most important cash crops of tribal people residing in the Kinnaur district of Himachal Pradesh and is being presently sold at very high rates Rs1500-2000/kg in the market. It plays an important role in the socio-economic life of the local communities residing in the tribal areas of Himachal Pradesh. Chilgoza cones are ruthlessly harvested every year for seed extraction. Harvesting of almost every cone by the right holders for consumption and marketing is one of the major reasons for the poor natural regeneration of this pine. There is no restriction imposed by the government on the local communities for the quantity of Chilgoza seeds which may be collected from the natural forest. Besides this, some left out seeds are immediately eaten by wildlife species especially rats, crows and birds. Severe biotic interference and lack of regeneration in this pine may result in the extinction of this species in years to come. This species is listed in the category “Near Threatened” as per IUCN threat category. Therefore, there is an urgent need to protect and conserve this valuable edible nut yielding conifer tree. The conservation of the conifer through various extension programmes and successful implementation of conservation programmes by ensuring participation of local communities in various afforestation programmes being undertaken by Forest Department and other agencies are critical to the future of this species.

DISTRIBUTION STATUS OF CHILGOZA PINE IN H.P.

Chilgoza Pine is sparsely distributed conifer confined to Eastern Afghanistan, North-Pakistan and North-Western Himalayan region of India. It occurs mainly in Sutlej Valley in Kinnaur District and some pockets of Pangi and Bharmour area in Chamba district of H.P. Besides this, it is also reported in Dachhin area in the Marwah valley of Doda (J&K) and Malari and Bampa area of Garhwal (Uttarakhand). In Kinnaur district, Chilgoza Pine occurs in Bhabanagar, Kilba, Pooh, Kalpa and Moorang Forest Ranges. In Chamba district, Chilgoza Pine occurs in Killar, Bharmour and Holi Forest Ranges .

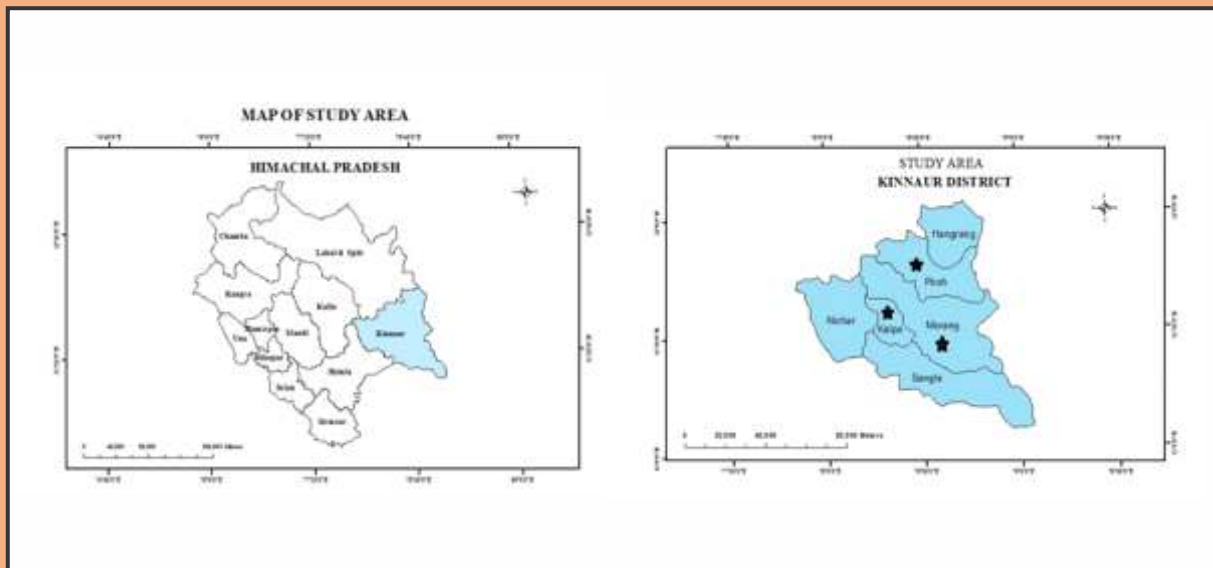


Fig-3 Map Showing Distribution of Chilgoza Pine in Kinnaur District, H.P.

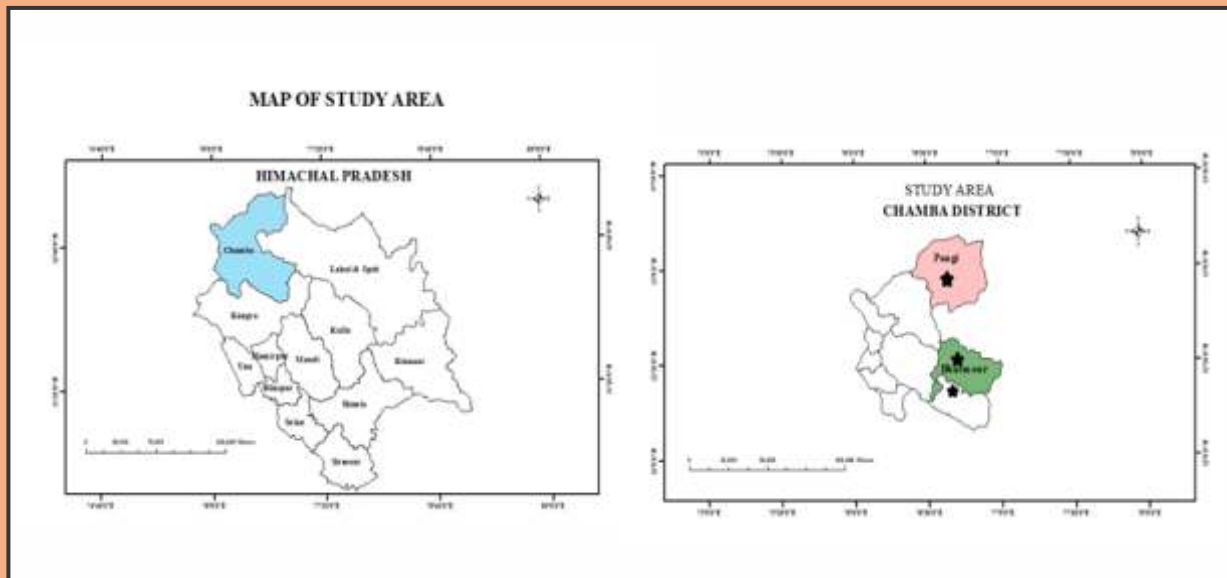


Fig-4 Map Showing Distribution of Chilgoza Pine in Chamba district, H.P.

SITE QUALITY:

Chilgoza Pine is found only in the inner arid valleys of the North-West Himalayas, where rainfall is scanty and heavy snowfall in winters. The total precipitation varies between 370-750 mm. It endures severe cold in winter. During the summer, it requires temperature less than 35⁰ C for its proper growth. It is capable of growing on excessively dry, barren hills-sides with shallow soil and even on bare rocks. It prefers soil with good drainage and light texture allowing adequate aeration for the development of root system.



Chilgoza Forest, Kinnaur



Chilgoza Growing on Steep Rocks

SILVICULTURAL CHARACTERS:

(i) Light: Medium light is required for growth of Chilgoza Pine. In its initial stage, the seedlings require little bit shade, however, in the later stage, light is essentially required for proper growth of Chilgoza seedlings and saplings in the nursery and plantation area.

(ii) Drought: Germinants and small seedlings cannot tolerate drought and long spell of drought proves fatal for its survival in the nursery and plantation area.

(iii) Frost: Seedlings and trees tolerate frost, however, long spell of frosty condition proves fatal for survival of seedlings.

(iv) Fire: The trees are sensitive to fire due to smooth and thin bark. Forest fire is quite fatal for its survival in the wild.

(v) Wind: The trees are wind firm due to their well-developed root system.

REGENERATION OF CHILGOZA PINE:

(I) Natural Regeneration:

The natural regeneration of Chilgoza Pine occurs through seeds in the natural habitat. Seeds which mature during October-November fall on the ground and germinate in natural forest during March-April after melting of snow when temperature and climatic conditions become favourable.

Natural regeneration of Chilgoza Pine is very poor and less than 15% occur in their natural habitat. The regeneration of Chilgoza Pine occurs only in those areas which are inaccessible to human exploitation especially in the crevices of rocks.

(ii) Artificial Regeneration:

The artificial regeneration of Chilgoza Pine is carried out through seeds in nurseries. Propagation through cuttings/grafting has been found to be quite difficult and very less rooting has been observed in this conifer species. Seedlings of Chilgoza Pine are raised in nurseries and later on transplanted in the field for various afforestation programmes.



Young Female Cone



Mature Female Cone

CONE HARVESTING:

The cones of Chilgoza Pine are generally harvested by the local communities during the months of September to October every year. In older times, traditional system of cone collection was prevalent in which villagers collected all the cones and distributed equally among themselves. The local people usually avoided unnecessary cutting of branches with a concern to preserve this valuable forest resource. However, since last couple of decades, most of the Chilgoza forests are auctioned to contractors by the villagers for collection of cones. Accordingly, village forest is divided into parts and allotted to contractors. These contractors hire un-skilled labourers from outside the Kinnaur district and employ them for harvesting cones from the Chilgoza forest. In some localities, the local people themselves collect the cones either in groups or on individual basis. The collectors mostly cut the cone bearing branches with sickle for collection of Chilgoza cones in the Chilgoza Forest and from their private land. The cones are then put

in the jute bags/other bags and then brought to the villages for drying and extraction of seeds.

CONE DRYING:

The cones are spread on the ground in shady place in a room and left for drying for 15-20 days. In older times, in some villages, people placed the cones in trenches and covered them with soil/thatch and put a fire over the pits for immediate extraction of Neoza nuts for their use. Cones are also kept in cowsheds for about a fortnight period till they open up and are then taken to open places for extraction of nuts.



Fully Opened Cone



View of Megasporophyll

SEED EXTRACTION:

The nuts/seeds of Chilgoza Pine are generally extracted from the cones manually by the local people especially women folk. Once the cone opens up, seeds are extracted by using “Adge” commonly called as “Basing” or “Basola” in local dialect. The cones are cut into four parts with help of Basola and thereafter, seeds are extracted from the cones manually.



Seed Extraction method



Women Folk Extracting Chilgoza Nuts

SEED MORPHOLOGY:

The seeds of *Pinus gerardiana* are borne in megasporophyll of the female cone and are brown in colour when they attain maturity. They are cylindrical, pointed, dark brown with a rudimentary wing, naked and covered with brown coloured seed coat. The size of seed is 2.63cm x 0.64cm x 0.52cm. Number of seeds per cone is approximately 60-70 and there are 3500-4500 seeds /Kg.



Chilgoza Seeds



Edible Chilgoza Nuts

SEED DRYING AND STORAGE:

The seeds of Chilgoza Pine after extraction from the cones are dried in the shade for some time by the villagers and thereafter, local people sell them in the local markets. The local communities also store Chilgoza nuts by using steel/other containers for their personnel use in various festivals and ceremonies.

Studies carried out by scientists of YS Parmar University of Horticulture & Forestry, Solan found that Solar tunnel drier is the best method for drying Chilgoza nuts and, glass jar and aluminium laminate pouches are the best packaging material for storage of nuts for enhancing its shelf-life on the basis of their better retention of physico-chemical properties of the nuts.

NURSERY TECHNIQUES:

(I) Preparation of Nursery Beds:

The seedlings of Chilgoza Pine are generally raised in polybags in the nursery. Before sowing of seed in polybags, potting media is prepared by mixing soil, farmyard manure and sand in ratio of 2:1:1 in the nursery. Polybags of size 18”x5” inches are filled with potting media and kept in the sunken nursery beds for seed sowing.

(ii) Seed Sowing:

The seeds of Chilgoza pine collected from healthy trees are treated with insecticides before sowing in the nursery. The seeds are sown at a depth of 3-4cm in polybags during the month of November-December and properly covered with soil mixture. Generally two seeds are sown in each polybag in the nursery. Watering of polybags is done to maintain moist condition which is necessary for seed germination. The polybags containing seeds are usually covered with nets or thatches to protect the seeds from being eaten by birds or rodents. After sowing, seeds of Chilgoza pine remain dormant in the polybags during winter season.

The seeds start germinating after melting of snow during March-April when the environmental conditions becomes favourable for seed germination. Germination percentage of seeds varies from 80-90% depending on the quality of seeds and climatic conditions during seed germination. In its initial stages after

germination, polybags containing seedlings are covered with shade for proper development of seedlings and thereafter, shade is removed from the nursery beds.

PLANTING TECHNIQUE:

The seedlings of *Pinus gerardiana* raised in polybags are kept in the nursery for 2½ to 3 years for its proper development. The growth rate of Chilgoza seedling is very low like other conifers of the western Himalayan region. As compared to shoot system, the growth of root system is relatively fast and roots attain double the size of shoot system in nursery. Due to faster growth of root system, polybags containing seedlings needs to be shifted frequently at least 2-3 times in a year to prevent the roots from striking in the soil. The plants become ready for planting after 2½ to 3 years of growth in the nursery.

Pits of size 45cm x 45cm x 45cm at a spacing of 2.5 m x 2.5m or 3 m x 3m are prepared 2 months before planting in the plantation area. Before planting, pits are properly filled with soil mixture. Thereafter, seedlings are transplanted in the pits with the help of planting bar by making a hole in the centre of pits. The pits containing seedlings are properly covered with soil mixture after planting and are watered frequently before they get established in the field. The plantation area is fenced properly with barbed wires to avoid damage to plants by domestic and wild animals.

USES OF CHILGOZA PINE:

(i) Medicinal Uses:

Chilgoza nuts are highly nutritious and eaten raw as well as in roasted form by the people. They are rich source of carminative, stimulative and anodyne which improves general debility of human beings. They also help in lowering high cholesterol levels and improve overall lipid profile because nuts contain huge amount of healthy unsaturated fats which are very beneficial for lowering high cholesterol levels. Nuts contain linoleic acid which plays an important role in the heart ailments. Chilgoza nut possesses antibacterial, antiviral, antifungal, antiseptic, antihypertensive, expectorant and diuretic effect. Oil obtained from these nuts is used for dressing of wounds, in ulcers, chronic arthritis, respiratory complaints, burns, cough and cold etc.

(ii) Domestic Uses:

Needles of Chilgoza Pine are collected by local people from forest in large quantities and used in the agricultural fields for retention of soil moisture and to improve soil fertility. The needles are also used as bedding in cowsheds of the cattle. They are used by the local communities to prepare farmyard manure for improving soil fertility of agricultural fields and horticultural plantations.

The branches of trees and wood are commonly used as fuel

wood in houses during harsh winter season and for fencing agricultural fields and orchards. The dried cones after extraction of Chilgoza nuts are also used as fuel during winter season. The resinous wood of Chilgoza Pine is used as torch wood by the local communities during various festivals and while working in the agricultural fields during night.



Chilgoza Wood as Fuel wood



Cones used as Fuel wood

(iii) Traditional Uses:-

The nuts of Chilgoza Pine are crushed and used as one of the ingredient for preparation of delicious local salty tea commonly called as “**Cha**”. The nuts after removal of seed-coat are used for preparation of garlands offered to the local deities, relatives and guests during wedding ceremonies, death ceremonies and important festivals all over the Kinnaur district.



Chilgoza Garland

SOCIO-ECONOMIC RELEVANCE OF CHILGOZA PINE:

Chilgoza Pine plays significant role in socio-economic life of the local people in its zone of occurrence in tribal areas of Himachal Pradesh. The people of Kinnaur district are highly dependent on Chilgoza Pine to meet their daily requirements as well as for improving their economic conditions. Chilgoza is one of the most important cash crops of tribal people residing in the Kinnaur. It contributes significantly to the annual income of the most of the families living in the areas of its distribution. In some of the households, revenue earned by selling of Chilgoza nuts is the main source of income for sustaining their livelihood. The approximate export value of its annual produce is around Rs. 18crore. It clearly reflects that Chilgoza Pine is not only ecologically important to the area but also plays an important role in improving socio-economic conditions of the local communities residing in Kinnaur district.

THREATS TO CHILGOZA PINE:

- **Unsustainable Harvesting of Cones:**

The area under Chilgoza forest has considerably decreased in Himachal Pradesh. Due to uncontrolled and unsustainable harvesting of cones by the collectors, none of the cones/seeds are left for its regeneration in the forest which poses a major threat for conservation of this valuable pine in its zone of occurrence.

- **Damage by Birds, Rodents & Reptiles:**

The seeds/cones that remains inaccessible to the collectors fall on the ground. Such seeds are eaten by monkeys, rats and birds and regeneration does not occur in the field. Birds, rodents and lizards also nibble away the tender young seedling in the forest. Because of their fleshy and tasty cotyledons, mortality of seedlings is high in the forest.

- **Grazing by Livestock:**

The young seedlings are nibbled or trampled by sheep and goats grazing in large number in Chilgoza forest which destroys young seedlings in the forest.

Damage by Insects and Pathogens:

During the time of flowering and seed formation, attack of insects and pathogens also leads to regeneration failure. The most damaging insect-pest attacking the seed and cone of this pine are *Leptoglossus corculus*, *Tetyra bipunctata* (seeds) and worms in genus *Dioryctria*(cones). Beside these, seed mycoflora also plays an important role in the spoilage of seed. Initially, greyish discolouration occurs at the point of infection and later, greenish fungal growth is observed on entire seed. Many of the seed-borne fungi like *Penicillium*, *Aspergillus*, *Mucor*, and *Rhizopus* often colonize seeds and finally destroy the seed. Chilgoza Pine nuts form a good substrate for *Aspergillus flavus* infestation and production of aflatoxins with potential hazard to the health of consumers.



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