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Variations in Tree Parameters of *Pinus wallichiana* in Different Geographical Coordinates of District Ganderbal

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ABSTRACT: The present investigation "Variations in tree parameters of *Pinus wallichiana* in different geographical coordinates of District Ganderbal" was carried out during the years 2022-23 and 2023-24 to study the effect of location on *Pinus wallichiana* height and DBH that will provide base as genetic makeup of superior plants can be propagated easily on vast programme. The tree height ranged from 15.2 m to 28.9 m. Height was recorded maximum (28.9 m) for tree (T₃), followed by (27.3 cm) tree (T₁) while as minimum height (15.2 cm) was recorded for tree (T₅). DBH of trees ranged between 18.3 cm to 47.7 cm. DBH was recorded maximum (47.7 cm) for tree (T₃), followed by (42.2 cm) tree (T1), whereas the minimum DBH (18.3 cm) was recorded for tree (T₅). Tree height was measured for eighteen randomly selected trees and it ranged from 15.2 m to 28.9 m, highest (28.9 m) being recorded for the tree (T₃) selected from Akhal. Also, the range of DBH among the selected trees was from 18.3 cm to 47.7, the maximum (47.7 cm) being recorded for the tree (T₃) of Akhal.

Keywords: Pinus wallichiana, Tree Height, Tree DBH, Geographical Coordinates, Ganderbal.

INTRODUCTION

Pinus wallichiana, commonly known as Blue pine, belongs to genus Pinus and family Pinaceae. Its other common names are Bhutan pine, Himalayan pine and Himalayan white pine. Pinus wallichiana "A.B. Jackson" is a coniferous evergreen tree reaching 30-50 m (98–164 ft) in height (Bhat et al., 2017). Branches are whirlpool, over throwing, usually rising in young trees and collapsing in old trees. Two whorls are mostly produced in one season. Male catkins reach 7 to 10 mm. expanded or elongated, green or dark reddish purple in colour. Leaves in tussock of 5, basal congruity deciduous, length is 15-20 cm, base is curved, tenuous, malleable, abaxial side is green and stomatal lines are bluish white in colour. Leaf clusters are commonly pendant but sometimes spreading also. The male cones mainly occur on lower branches, once and again in dense bunches on younger sprig. Female cones are 20-30 cm long, often occurs in groups of 1-6 cones, perpendicular when juvenile and pendant when mature. Colour of female cone in young stage is bluish green but in mature stage, it 16 turns into pale brown to light brown colour. Shape of cone scales are wedge like, apex is usually wide and very resinous (Sinha, 2019). This species does not tolerate shade and prefers welldrained, porous soils; it can also grow on limestone if there is sufficient soil depth above the rock (Singh and Yadav 2000). It is extensively distributed throughout the entire length of the inner Himalayas, ranging in altitude from 1219 to 3657 m, which exceeds that of any other conifer species in the Himalayas (Troup, 1921). Studying variability is crucial before developing tree improvement strategies (Sharma *et al.*, 1994). However, there is limited information about the tree parameters and geographical coordinates of *Pinus wallichiana* in district Ganderbal. The aim of the present study was to information about the tree parameters and geographical coordinates of *Pinus wallichiana* in district Ganderbal.

MATERIALS AND METHODS

The experimental field where study was conducted is located at $34^{\circ}16' 4''$ North and $74^{\circ}46' 31''$ East longitude on the southern aspect. The study area was situated above mean sea level at an elevation of 1,783 m (5850 feet) Fig. 1. The area was hilly, has ups and downs and visible elevations and lowered topography and a slope in the direction of south-eastern aspect. To assess genetic variability, six sites were selected.

Tree characters

1. Tree height (m). The height of each selected tree was measured in meters with the help of Ravi's multimeter.

2. Tree DBH (cm). The diameter at breast height (1.37 m) was measured in meters for each selected tree using a diameter tape.



Fig. 1. Location of sites in district Ganderbal.

RESULTS AND DISCUSSION

Table 1 represents the tree height of the selected *Pinus* wallichiana trees. The tree height ranged from 15.2 m to 28.9 m. Height was recorded maximum (28.9 m) for tree (T₃), followed by (27.3 cm) tree (T₁) while as minimum height (15.2 cm) was recorded for tree (T₅). DBH of trees ranged between 18.3 cm to 47.7 cm. DBH was recorded maximum (47.7 cm) for tree (T₃), followed by (42.2 cm) tree (T₁), whereas the minimum DBH (18.3 cm) was recorded for tree (T₅). Tree height was measured for eighteen randomly selected trees and it ranged from 15.2 m to 28.9 m, highest (28.9 m) being recorded for the tree (T₃) selected from Akhal. Also, the range of DBH among the selected trees was from 18.3 cm to 47.7, the maximum (47.7 cm) being recorded for the tree (T₃) of Akhal. The maximum height and

diameter at breast height might result from favourable locale characteristics, such as topography, edaphic conditions and climate. According to Troup (1921), blue pine flourishes best in the Western Himalayas in an altitudinal range of 1,800-2,5000 masl, here it is gregarious, often forming extensive pure crops, owing to its capacity to come up in dense even aged masses. Because the species is extensively spread across the inner Himalaya, with an altitudinal range of 1,219 to 3,657 masl, larger than any other Himalayan conifer, it exhibits enormous geographic variation. This variability within a population of tree species has been explanted during the selection of superior provenance for a specific site to develop approaches to the conservation of genetic diversity within a population of tree species (Troup, 1921).

Sites	Trees	Altitude (m)	Latitude	Longitude	Height (m)	DBH (cm)
Akhal	T	2559.28	34°15′22.80″N	74°53′54.23″E	27.3	42.2
Akhal	T_2	2685.10	34°17′19.12″N	74°55′52.13″E	25.2	40.5
Akhal	T ₃	2200.27	34°16′96.34″N	74°55′02.32″E	28.9	47.7
Anderwan	T ₄	2555.60	34°16′45.82″N	74°47′72.11″E	16.8	19.5
Anderwan	T ₅	2681.42	34°17′02.92″N	74°52′82.32″E	15.2	18.3
Anderwan	T ₆	2441.83	34°16′52.44″N	74°49′32.02″E	16.9	20.9
Gutlibagh	T ₇	2339.78	34°17′18.30″N	74°49′45.12″E	19.6	25.8
Gutlibagh	T ₈	2453.55	34°16′92.42″N	74°50′18.42″E	19.1	25.6
Gutlibagh	Т,	2579.37	34°15′82.72″N	74°48′92.23″E	18.9	23.3
Walliwar	T ₁₀	2432.69	34°13′42.13″N	74°53′6.12″E	20.7	29.1
Walliwar	T ₁₁	2546.46	34°14′32.89″N	74°53′5.22″E	20.1	28.4
Walliwar	T ₁₂	2672.28	34°14′01.32″N	74°53′503.22″E	19.9	26.7
Wussan	T ₁₃	2408.33	34°16′89.32″N	74°50′49.22″E	23.8	36.8
Wussan	T ₁₄	2522.10	34°17′45.60″N	74° 49'92.32"E	23.6	35.3
Wussan	T ₁₅	2647.92	34°17′28.72″N	74°50′28.22″E	22.5	32.5
Fraw	T ₁₆	2215.27	34°16′51.80″N	74°59′32.11″E	18.7	22.4
Fraw	T ₁₇	2329.04	34°16′42.79″N	75° 30′ 54.21″ E	18.3	23.1
Fraw	T ₁₈	2454.86	34°16′40.32″N	75° 24'01.11″E	17.2	20.7

Table 1: Tree parameters of Pinus wallichiana in different geographical coordinates of District Ganderbal



Furthermore, maximum tree height might be linked to a higher tree density. The maximum tree height is an essential measure for understanding numerous aspects of plant communities, including total standing biomass and resource usage (Enquist *et al.*, 2009). When trees are densely populated, they often grow taller as a coping mechanism against light competition while stunted growth at higher elevations is a local adaptive measure to prevailing harsh site conditions. These outcomes correspond with those of Kempes *et al.* (2011). They found in Smith fir (*Abies georgei*) both the mean annual growth rate and the maximum/mean tree height decreased with altitude. Significant aspects

of tree performance are impacted by high-altitude environmental factors, including low temperature, water stress brought on by low temperature, poor nutrient availability and severe winds. The physiological processes that are responsible for tissue formation, such as photosynthesis, respiration, food allocation, and shoot growth, are restricted by environmental factors, particularly low temperatures, at high altitudes (Sklenar *et al.*, 2011). As a result, the dbh, basal area, tree height and crown spread of trees are significantly reduced. Korner (2012); Sajad *et al.* (2023) asserted that as altitude rises, changing conditions limit tree growth.



Fig. 2. Some of the trees from sites.

CONCLUSIONS

The current study is the first of its kind about the tree parameters and geographical coordinates of Pinus wallichiana in district Ganderbal. The tree height ranged from 15.2 m to 28.9 m. Height was recorded maximum (28.9 m) for tree (T_3), followed by (27.3 cm) tree (T_1) while as minimum height (15.2 cm) was recorded for tree (T₅). DBH of trees ranged between 18.3 cm to 47.7 cm. DBH was recorded maximum (47.7 cm) for tree (T_3), followed by (42.2 cm) tree (T_1), whereas the minimum DBH (18.3 cm) was recorded for tree (T₅). Tree height was measured for eighteen randomly selected trees and it ranged from 15.2 m to 28.9 m, highest (28.9 m) being recorded for the tree (T₃) selected from Akhal. Also, the range of DBH among the selected trees was from 18.3 cm to 47.7, the maximum (47.7 cm) being recorded for the tree (T_3) of Akhal Fig. 2.

FUTURE SCOPE

Pinus wallichiana in district Ganderbal will provide base as genetic makeup of superior plants can be propagated easily on vast programme.

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