

## Studying Quantity and Quality of Coniferous Species in Arasbaran Forests (Case Study: Heresar and Kalaleh Regions)

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**Abstract:** Due to viability and growth assessment of twelve planted coniferous species in 1996 located in Arasbaran forests, Heresar and Kalaleh regions were studied. These species are including *Pinus pinea*, *Cupressus sempervirens var horizontalis*, *Pinus nigra austrialia*, *Pinus eldarica*, *Cedrus atlantica*, *Cupressus arizonica*, *Pinus sylvestris*, *Picea abies*, *Pinus pallasiana*, *Pinus carmanica*, *Pinus brutia* and *Larix decidua*. Statistical design of completely randomized block was used in this study. Number of four replicate in Kalaleh altitudes and three replicate in Heresar with 36 individual saplings for each replicate were selected. All of species were surveyed on basis of height, collar diameter, viability percent, vigor, death (freeze) number, two branching and decline of saplings. Whole of characters had significant statistical differences on basis analysis of variance except vigor with code 2 (weak decline, damage between 10 to 25%). Totally, the mean of Viability percent, collar diameter and height were 88.88%, 13.56% and 5.44%, respectively. Code 1 of vigor (healthy, damage less than 10%), with mean of 20.6 had the highest value and significant differences considered with other of vigor's codes. *Pinus eldarica*, *Cupressus arizonica*, *Pinus pallasiana* and *Pinus brutia* had the most viability among whole of species. Kalaleh region (northern slope) had more appropriate ecological condition than to Heresar (southern slope) with considering surveyed characters. More moisture, less sunlight and the better water balance is effective factors on successful of planted species in northern slope than to southern slopes.

**Key words:** Quality and quantity survey • Viability • Needle leaves vigor • Arasbaran forests

### INTRODUCTION

Iran forests with 11.2 million hectare areas are distributed in different regions [1]. These forests divided to Hyrcanian, Arasbaran, Zagros, Irano - Touranian and khalij - Omani regions on the basis of growth climate and distribution regions of woody species [2]. East Azerbaijan province located in northwest of Iran with 4.5 million hectare areas which covered 120000 hectare areas of woodland established in heights of Ghareh Dagh continuous mountains and named as Arasbaran forests [3].

By reason of Iran geographical position in dried climate belt, studying compatibility of industrial species with low needs especially needle leaves is essential in afforestation development [4]. Needle leaves have especial important because of low needs, growth rate and application in many of industrials for example forgery,

medical uses, grocery and etc. Also, needle leaves are more considerable than to broad leaves because of having direct bole and short - time exploitation [5].

This research as a statistical investigation is trying to presentation of presence position of afforestation management plan in Arasbaran forests in Heresar and Kalaleh regions. Also, quality and quantity conditions studied for introducing appropriate species in afforestation programs of degraded areas. Studying on needle leaves has long record in Iran. The first survey in statistical designs framework carried out by forests and rangelands researches institute for determination compatibility and comparison of species in different ecological condition from 1969.

On the basis of this report, investigation of suitability on *pinus teada* and the other species in researches station of polimbera, Astara, Seravan of Rasht forests showed that planting successful this species was

considerable pay attention to viability, settlement and growth as an exotic pine [4]. Investigation 13 species and provenance of needle leaves, from 1988 in low altitudes of Asalem resulted that *pinus teada* with American origin was dominance viewpoint height, collar diameter, viability percent and vigor.

In midland regions of Nave - Asalem, *picea* and *abies* species were considered as the best successful among 15 species and different provenances. The upland of same region, *larix leptodepsis* was the most adapted species among different nine species and provenance [6]. Investigation of needle leaves different species in Mediterranean and Ejuh sea shores showed that *pinus brutia* has appropriate growth rate in Mediterranean regions. In southern beaches of Ejuh Sea, *pinus brutia* and in northern beach, *pinus ambliifera* were successful of other species [7].

## MATERIALS AND METHODS

**Geographical Position:** Due to assessment of viability and growth of needle leaves different species, twelve planted coniferous species in 1996 located in Arasbaran forests, Heresar and Kalaleh regions were studied. Heresar region with 38° 54' northern latitude and 46° 44' east longitude located in 1400 meter altitude and south east aspect. Kalaleh region with 38° 55' northern latitude and 46° 44' east longitude located in 1000 meter altitude. Total areas of regions are 3 hectare. In Kalaleh region 144 individual in four replicate and Heresar region 108 individual in three replicate, on the average 252 individual for each species were studied. Totally, 3024 individual of whole species were surveyed.

### Research Method

#### Measured Characteristics:

- Quantity characters including height and collar diameter measuring, investigation of viability condition, calculating number of death (freeze) sapling.
- Quality characters including branching (code 1: trees with two or more branches; code 2: trees without two or more branches), vigor (code 1: healthy, damage less than 10%; code 2: weak decline, damage between 10 to 25%; code 3: average decline, damage between 26 to 50%; code 4: severe decline, damage more than 50%; code 5: natural death; code 6: tree death by human).
- Measuring degree of damage.

**Data Analysis:** After of census inventory in two regions and collecting of necessary information, data were entered in SPSS and Excel statistical programs. Height, diameter curves and statistical parameters (mean, standard deviation and etc.) extracted for whole of species. Duncan was used for compare means of statistical tests.

## RESULTS

**Collar Diameter:** *Pinus pallasiana* and *Pinus sylvestris* had the most mean of collar diameter in two regions of Heresar and Kalaleh among twelve species with mean of 13.56cm and 13.09 cm, respectively. *Cedrus atlantica* with collar diameter mean of 2.83cm had the least mean in two studied regions. In Kalaleh region, *Pinus brutia* with mean of 14.62 cm had the first level, whereas *Pinus pallasiana* and *Pinus sylvestris* with 14.34 cm and 13.59 cm means devoted in the next levels. In Heresar region, *Pinus pallasiana* with mean of 12.54 cm had the first level, whereas *Pinus sylvestris* and *Cedrus atlantica* with 12.43 cm and 10.09 cm means devoted in the next levels (Fig. 1). In the whole of species between two sampling regions of Heresar and Kalaleh haven't significant differences at confidence limit of 95% (Table 1).

**Height:** *Pinus sylvestris*, *Cupressus arizonica*, *Pinus nigra austrialia*, *Pinus brutia* and *Pinus pallasiana* with height means of 5.44m, 4.59m, 4.52m, 4.34m and 4.32m had the most mean in studied regions, respectively. *Cedrus atlantica*, *Picea abies* and *Larix deciduas* species with height means of 1.53m, 2.03m and 2.10m had the least mean in two regions among twelve species (Fig. 2).

**Viability Percent:** *Pinus brutia*, *Pinus pallasiana*, *Cupressus arizonica* and *Pinus eldarica* with viability percent mean of 88.88%, 81.74%, 80.98% and 80.55% had the most viability in Heresar and Kalaleh regions among twelve species, respectively. *Picea abies* and *Pinus pinea* with viability mean of 33.73% and 34.92% had the least viability in two regions (Table 2). *Pinus nigra austrialia*, *Pinus sylvestris*, *Picea abies* and *Pinus pallasiana* had significant differences (at confidence limit of 99%) between Heresar and Kalaleh regions considering viability percent.

**Death (Freeze) Number:** *Larix decidua*, *Picea abies*, *C. horizontalis* and *Pinus pinea* species had the most death number among twelve species in Heresar region, whereas *Cupressus arizonica* had the least death number (Table 2).

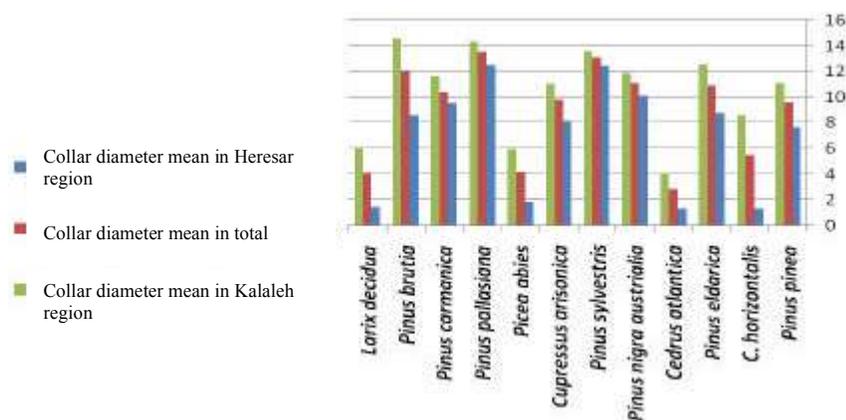


Fig. 1: Collar diameter mean for studied species

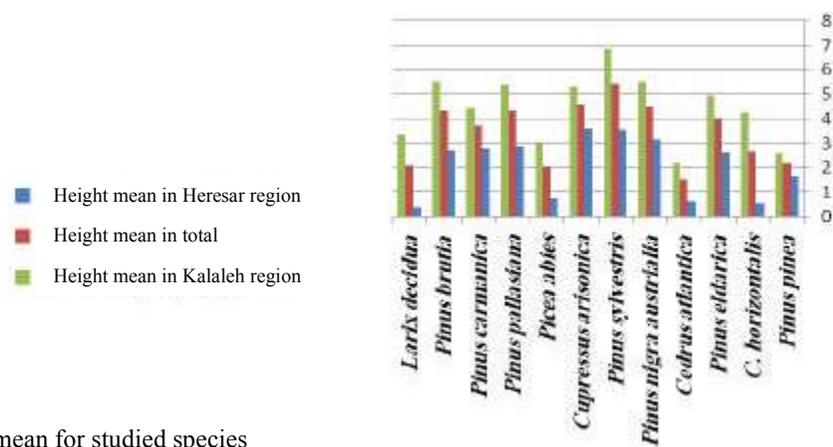


Fig. 2: Height mean for studied species

Table 1: Analysis of variance on basis of sampled regions for collar diameter

Species	F test		Species	F test	
	Collar diameter			Collar diameter	
<i>Cupressus arizonica</i>	0.44	ns	<i>Pinus pinea</i>	0.68	ns
<i>Picea abies</i>	4.25	ns	<i>C. horizontalis</i>	5.40	ns
<i>Pinus pallasiana</i>	0.17	ns	<i>Pinus eldarica</i>	0.49	ns
<i>Pinus carmanica</i>	0.26	ns	<i>Cedrus atlantica</i>	2.68	ns
<i>Pinus brutia</i>	1.18	ns	<i>Pinus nigra australis</i>	0.08	ns
<i>Larix decidua</i>	3.45	ns	<i>Pinus sylvestris</i>	0.07	ns

ns = not significant

Table 2: Viability percent and death number means in different regions

Species	Heresar region		Kalaleh region	
	Viability (%)	Death number	Viability (%)	Death number
<i>Pinus pinea</i>	13.89	31.00	50.69	17.75
<i>C. horizontalis</i>	12.04	31.67	74.31	9.25
<i>Pinus eldarica</i>	64.81	12.67	92.36	2.75
<i>Cedrus atlantica</i>	20.37	28.67	65.28	12.50
<i>Pinus nigra australis</i>	33.33	24.00	86.11	5.00
<i>Pinus sylvestris</i>	23.15	27.67	96.53	1.25
<i>Cupressus arizonica</i>	61.19	5.33	95.83	1.50
<i>Picea abies</i>	5.56	34.00	54.86	16.25
<i>Pinus pallasiana</i>	58.33	15.00	99.31	0.25
<i>Pinus carmanica</i>	51.85	17.33	74.31	9.25
<i>Pinus brutia</i>	75.93	8.67	98.61	0.50
<i>Larix decidua</i>	2.78	35.00	72.22	10.00

Table 3: Decline mean and standard deviation for studied species

Species	Decline (%)	Species	Decline (%)
<i>Cupressus arizonica</i>	10.4±0.02	<i>Pinus pinea</i>	38.8±0.04
<i>Picea abies</i>	36.4±0.06	<i>C. horizontalis</i>	42.4±0.03
<i>Pinus pallasiana</i>	10.2±0.01	<i>Pinus eldarica</i>	10.8±0.02
<i>Pinus carmanica</i>	12.5±0.03	<i>Cedrus atlantica</i>	36.5±0.05
<i>Pinus brutia</i>	11.2±0.02	<i>Pinus nigra austrialia</i>	10.5±0.03
<i>Larix decidua</i>	37.2±0.05	<i>Pinus sylvestris</i>	10±0.02

**Vigor:** *Cupressus arizonica*, *Pinus brutia*, *Pinus pallasiana* and *Pinus eldarica* had the most vigor mean of code 1 with 32.42, 30.57, 28.71 and 27.42 values in studied regions, respectively. *Pinus pinea* species had the least vigor with code 1 and 4.7 value. *Pinus pinea*, *Larix decidua*, *Picea abies* and *C. Horizontalis* had the least vigor with code 1 in Heresar region. In Kalaleh, *Pinus pallasiana* with 35.75 individual and then *Pinus sylvestris*, *Pinus brutia* and *Pinus eldarica* with 34.75, 34.75 and 33.25 individual were in the next levels. In Heresar, considering vigor with code 1, *Cupressus arizonica* with 29.67 individual had the maximum value and then *Pinus brutia* with 25 individual and *Pinus eldarica* with 19.67 individual had the highest individuals.

**Branching:** *Cupressus arizonica*, *Pinus pallasiana*, *Pinus eldarica* and *Pinus brutia* had the most branching mean with code 1 in two regions and among species with 32, 29.14, 28.42 and 27.57 individual, respectively. *Pinus pinea*, *C. horizontalis*, *Cedrus atlantica*, *Pinus eldarica*, *Picea abies*, *Larix abies* and *Larix decidua* had the least branching of code 1.

**Damage and Decline Degree:** *Cupressus sempervirens var horizontalis*, *Pinus pinea*, *Larix decidua*, *Cedrus atlantica* and *Picea abies* had the most declines with 42.4%, 38.8%, 37.2%, 36.5% and 36.4% in studied regions, respectively. *Pinus sylvestris*, *Pinus pallasiana*, *Cupressus arizonica* and *Pinus eldarica* had fewer damages (Table 3).

## DISCUSSION

Analysis of variance on basis of collar diameter for studied species in 2008 showing that mentioned character had significant differences that are indicating different growth of species. The most mean with 13.09 cm devoted in *Pinus sylvestris* that is due to its high forbearance. *Pinus sylvestris*, *Pinus pallasiana* and *Pinus nigra* with more collar diameter can be because of suitable climatic conditions [8]. Fattahi [9] studied the compatibility of exotic needle leaves species in Kurdistan (west of Iran). The results of his research showed that *Pinus nigra* had

height and diameter increment mean of 0.11m and 0.32cm, respectively in last 30 years. He reported this species has high compatibility with region condition.

ANOVA of viability percent for Heresar and Kalaleh regions in 2008 showed significant differences among studied species that is indicating species differences reaction to planting bed. *Pinus eldarica*, *Cupressus arizonica*, *Pinus pallasiana* and *Pinus brutia* had the most viability among species. *Pinus eldarica* has the high agreement with unfavorable condition [10] and *Cupressus sempervirens var horizontalis* is a species that is resistant to drought and climatic unsuitable condition. The success of *Pinus nigra* is due to its resistant opposite to heavy winter [8] and the high viability of *Pinus brutia* is due to growth in sandy soils with low nutrient [11].

Fattahi [5] in his research during 13 years showed that length growth of *Pinus eldarica* and *Cupressus sempervirens var horizontalis* and also two variety of *Pinus nigra* were the most value among other species in oak forests of Iran west. ANOVA of height mean in 2008 for two regions were significant that is indicating different length growth of species. *Pinus sylvestris* and *Cupressus arizonica* with 5.44m and 4.59m length growth, respectively had the high value that is due to appropriate settlement of roots in soil, probably. Statistical result of death number is indicating different response and resistance of species to planting bed. The most mean of death number were devoted in *Picea abies*, *Pinus pinea*, *Larix decidua* and *Cedrus atlantica* with 23.85, 23.42, 20.71 and 19.42 individual. The reason of more death of *Picea abies* and *Cedrus atlantica* can be related to theirs need to high moisture [8].

Gorji Bahri [4] showed that *Picea abies* is adapted to Farim region condition of Mazandaran province (north of Iran) with 95% viability. Viability percent of species in Kalaleh region with mean of 80.035% is more than of Heresar region with mean of 35.27%. The dominance reason of Kalaleh region in compare to Heresar is related to its geographical position that is located in northern aspect, thus sun light intensity is higher. In Kalaleh, the viability percent wholes of species were more than 70% except *Picea abies*, *Cedrus atlantica* and *Pinus pinea*. In Heresar, viability percent of *Pinus brutia* was more than 70%, alone. In Kalaleh the least viability percent devoted

in *Pinus pinea* and *Picea abies* with 50.69% and 54.86% whereas, their viability percent in Heresar region were 13.89 and 5.56%, respectively.

The lower viability percent of these species in two regions (especially Heresar) can be related to their high humidity needs [8]. The considerable difference in viability of *Larix decidua* in studied regions (72.22% and 2.78%, respectively in Kalaleh and Heresar) is due to lower forbearance to drought. Fattahi [5] reported weak compatibility of this species during to 13 years experiment in Kurdistan, also. Appropriate viability of *Pinus eldarica* in two regions, with average of 80.55% is indicating heat and drought acceptance and resistance to extensive changes range of temperature and the other environmental factors [12]. This subject is according to Fisher [13] results in New Mexico State of America. In an experiment in Turkish, this species with Iranian origin had the highest level viewpoint agreement and growth in rain water condition among the other studied species.

Height mean in Kalaleh is 4.47m and in Heresar is 2.115m and collar diameter mean in Kalaleh and Heresar are 10.45cm and 6.97 cm, respectively. This subject is confirming more appropriate environmental condition in Kalaleh region. Collar diameter mean of *Pinus brutia* with 14.62 cm in Kalaleh has the first level and in Heresar, *Pinus pallasiana* with 12.54 cm had the first degree and showed the high differences with the other species. In Kalaleh, *Pinus pallasiana* and *Pinus sylvestris* with 14.34, 13.59 cm had the next levels. In Heresar, *Pinus sylvestris* and *Cedrus atlantica* with 12.43cm and 10.09cm had the next level, respectively. *Pinus sylvestris* and *Pinus nigra* had more collar diameter due to high resistance and contented and appropriate climatic condition, respectively [8]. Fattahi [5] studied exotic needle leaves of Kurdistan showed that *Pinus nigra* species had height and diameter increment mean 0.11m and 0.32cm, respectively and had good collusion with region condition.

With considering obtained results, for performing afforestation plan in this region proposed to: (1) for selection of species it should be considered to species ecological needs and region climatic condition. (2) for afforesting with exotic species in extensive areas, the agreement of species should be studied and endemic species must be more considerable. (3) using *Pinus sylvestris*, *Cupressus arizonica*, *Pinus pallasiana* and *Pinus brutia* for afforestation programming in degraded regions. (4) in afforestation, the relation between species and slope aspect, species and water needs be considered.

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