

New Spread Area And Ecological Evaluation Of Turkish Pine In Turkey

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Abstract— Turkish pine (*Pinus brutia* Ten.) has an ecological and economic importance for Turkey. Because of its fast growth, drought tolerance, wide distribution are (5.6 million ha), use of its wood in many areas, resin production and etc. In this study, the natural distribution area and productivity of the Turkish pine in Yenişarbademli (Isparta) has been investigated. Thus, it is intended to make contribution to the information regarding the natural distribution of this species in Turkey. 9 sample plots were determined in order to determine the productivity of the site that was determined according to the site index values. The site index values of the sample areas are calculated as 14.1m, 8.8m, 14.5m, 23.3m, 20.1m, 15.2m, 13.5m, 16.5m, 18.2m and the average site index value is calculated as 16m. The calculated value indicated that the Turkish pine stand is in the site class 3.

Keywords—*Pinus brutia*, Turkish pine, new distribution

I. INTRODUCTION

The species of pinus genus which has the largest distribution area in Turkey is Turkish Pine (*Pinus brutia* Ten), is also one of the diploxylon pine species. This pine species is one of the typical species of Eastern Mediterranean region, performs its most part of the natural distribution in Turkey [1]. Across the world, it has a distribution as small stands in Palestine, Jordan, Syria, Iraq, Lebanon, Greek islands, Italy, Cyprus, Georgia and Russia's Black Sea coast [2,3].

In Turkey, it performs its most part of the natural distribution in the areas of Mediterranean Region, under the influence of marine climate. Additionally, it also establishes forests in territories of Aegean, South Marmara, Western and Middle Black Sea regions which show a similar climate to the Mediterranean. It is also spreading in Adıyaman, Gaziantep, Kahramanmaraş and Siirt regions of the Southeastern Anatolia [4].

Turkish pine is the primary tree species with the widest distribution in Turkey. The area covered by Turkish pine forests are 3,451,269 ha of at normal, 2,158,946 ha of at degraded forest quality, total

5,610,215 ha. This area corresponds to 25.1% of Turkey's forests [5].

It is generally spread out according to the characteristics of the Mediterranean climate; climatic conditions with dry and hot in summers, warm and rainy in winters. The propagation regions of the Turkish pine have an average annual temperature of 10-25 °C with an average annual rainfall of 400-2000 mm [4].

Because of its fast growth, drought tolerance, wide distribution are (5.6 million ha), use of its wood in many areas, resin production and etc., It has an ecological and economic importance for our country [6]. For these reasons, it is important to ensure the continuity of the natural Turkish pine forests and rehabilitation of the degraded it. In this study, in order to contribute to the distribution of Turkish pine, the conditions of growing environment were investigated.

II. MATERIALS AND METHODS

The study area Yenişarbademli is located within the borders of Isparta province in Turkey and between 37° 43' latitude and 31° 23' longitude. It is surrounded by Beyşehir to the east, Aksu to the west and Şarkikaraağaç districts to the north (Figure 1). The altitude of the district is 1150 m. It has a climate conditions between the Mediterranean and the continental climate, closer to the continental climate. Annual average temperature and average precipitation are 11.3 °C and 727.8 mm respectively.

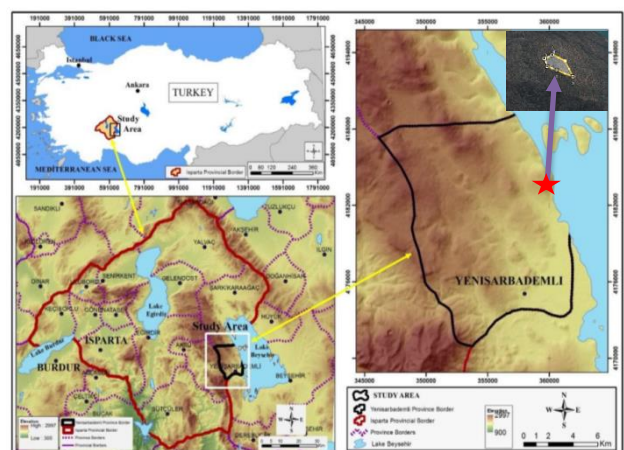


Fig. 1: The map of the study area

Yenişarbademli is integrated with the Anamas Mountains, the northern extension of the Taurus Mountains to the west of Lake Beyşehir. Some important hills in the study area are Uluin H. (1250 m), Asar H. (1251 m), Orta H. (1203 m), Kale H. (1267 m) and Küredin H. (1335 m). Important rivers are the Kuduz stream and Pınargözü Creek. Kuduz stream starts from Anamas Mountain and passes between Yenişarbademli and Kurucaova, and flows into Lake Beyşehir from the south of Gölyaka. Pınargözü stream passes from the south of Yenişarbademli to the north of Gölyaka and flows into Lake Beyşehir.

The Turkish pine in the Yenişarbademli district was first identified by me in a field study in October 2016 (Figure 2). According to the literature survey, no study has been found about the Turkish pine is located in the Yenişarbademli region. In this research, the natural distribution area and site productivity (site index) of the Turkish pine in Yenişarbademli has been investigated. Thus, it is intended to make contribution to the information regarding the natural distribution of this species in Turkey. For this purpose, 9 sample plots, which are thought to have different site conditions, were determined. In order to determine the site productivity 3 tallest trees were identified in each sample area and their age and top height measurements were performed. After that all height measurements were indexed to the age of 100 years [7] and their averages were calculated. According to the obtained results, the site productivity was determined [8].



Fig. 2. General view of study area

III. FINDINGS

The elevation of the distribution area of Turkish pine in the Yenişarbademli region is within the aforementioned elevation range of the taxon. In this region, the Turkish pine creates a stand consisting of 120 trees on a slope facing southern, with area about 200m x 180m. The distribution area in this region is limited to this field only. This field is a suitable site for growing of the Turkish pine due to its southern-facing and protective against freezing winds. Crimean juniper (*Juniperus excels* Bieb.) surrounds and dominates the area around the Turkish pine. However, in the Turkish pine stand, olive (*Olea europaea* L.) and *Pistacia terebinthus* L. species which are the indicator species of the Mediterranean climate, were found. Apart from these, Mount Tabor's oak (*Quercus ithaburensis* subsp. *macrolepis*) and prickly juniper (*Juniperus oxycedrus* L.) were also observed. Another dominant species in the region is black pine (*Pinus nigra* Arnold.). It has left their places to junipers in the habitat where ground cover is poor.

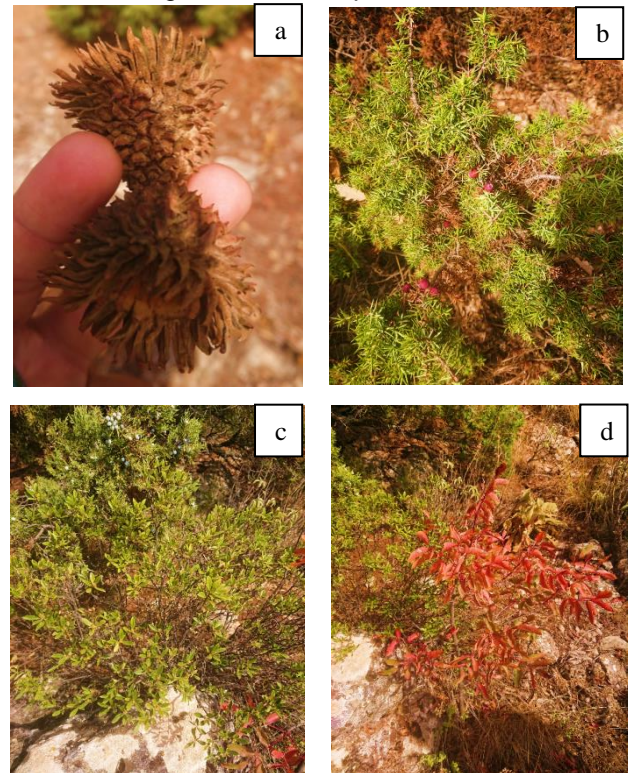


Figure 3. The other plant species of study area
(a: *Quercus ithaburensis* subsp. *macrolepis*;
b: *Juniperus oxycedrus* L.; c: *Olea europaea* L.;
d: *Pistacia terebinthus* L.)

According to measurements on the stand of Turkish pine (breast-height diameter over 8cm) in the Yenişarbademli district, it was determined that the ages ranged between 14-98 years, breast-height diameters between 10-52 cm and top heights ranged between 4.9-13.1 meters.

In addition, 9 sample plots were determined in order to determine the growth productivity of the environment and the growth productivity of the environment of these areas were determined by the

site index values. The site index values of the sample areas are calculated as 14.1m, 8.8m, 14.5m, 23.3m, 20.1m, 15.2m, 13.5m, 16.5m, 18.2m and the average site index value is calculated as 16m (Table 1). The calculated value indicated that the stand is in the site class 3.

TABLE I: PROPERTIES OF SAMPLE PLOTS

Sample Plot	Site Index(h100)	Site Class	Aspect
1	14.1	III	150°
2	8.8	III	148°
3	14.5	III	154°
4	23.3	II	158°
5	20.1	II	122°
6	15.2	III	118°
7	13.5	III	98°
8	16.5	III	132°
9	18.2	III	130°

Besides, during the field surveys, some of the trees were suffered from "pine processionary moth (*Thaumetopoea pityocampa* Schiff.)" (Figure 4).



Fig. 4. Nests of the pine processionary moth

IV. RESULTS AND DISCUSSION

In the Yenişarbademli district, which is the area of research, Turkish pine was discovered in a field about 3.6 ha and at 1300 m average altitude. This field is southern-facing and it has a protective nature against freezing winds. Similarly, in the Western and Central Black Sea, it is seen on the south-facing slopes in the valleys protected from the effect of cool climate coming from the Black Sea [9]. In terms of elevation, Turkish pine has been seen up to 1300 m height in the Mediterranean Region [4].

In order to determine the growth productivity of the study area, 9 sample plots were determined and the average site index value of these areas was calculated as 16m. This result shows that this new Turkish pine stand is inefficient (site class 3). It is thought the weakness of the environment is caused the weak growth of some trees and consequently, the pine processionary moth attacked these trees.

The plots with the highest site index values are the 4th and 5th sample plots (Table 1). The high productivity of these sample plots is thought to be due to soil factors. It is estimated that the carried soils accumulated between 2 slopes in these places have increased the soil depth and resulted a positive effect on the growth of Turkish pine here, therefore, these plots developed better than other plots. Özkan and Kuzugüdenli (2010) reported that soil depth is effective in height development of trees, in a study of theirs about the productivity of Turkish pine in the Isparta region [10].

In the Mediterranean region, where the Turkish pine's highest distribution area in the Turkey, natural distribution areas of it is formed according to the topographic structure and climatic characteristics. In the Yenişarbademli district placed in the southern part of the Mediterranean the mountains with over 2500 meters height prevent entry of the warming effect of the sea to interior of the region, the average annual temperature decreases down to 12 degrees. Therefore, the district has a lower temperature values than the Mediterranean region and has higher temperature values than the Central Anatolia region. In the summer months, extreme high temperatures observed in the district, can be replaced by extreme cold in the winter months. Although the district is located in the Mediterranean region, summer temperatures and drought values are lighter than average of the Mediterranean region. In the winter months, it snows often like the continental climate. With these characteristics, the district differs from Mediterranean climate and the displays a transition climate. In this study, it is determined that Turkish pine will grow not only in the coastal region which has a marine effect, but also in the inner parts where the transition climate is dominant.

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