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Research note

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BIOCLIMATIC REQUIREMENTS OF *QUERCUS VULCANICA* (BOISS ET HELDR. EX) KOTSCHY – AN ENDEMIC SPECIES IN TURKEY

ABSTRACT: There are 18 *Quercus* species in Turkey, and *Quercus vulcanica,* called "Kasnak oak" in Turkish, is an endemic species. The Kasnak oak has been studied in three localities where the well formed communities of this species exist. The evaluation of bioclimatic tolerance ranges of Kasnak oak in Turkey was the aim of the study. Overall results support that Kasnak oak prefers humid conditions in ambient habitat.

KEY WORDS: *Quercus vulcanica* (Kasnak oak), bioclimatic requirements, Mediterranean bioclimate

There are 18 *Quercus* species in Turkey, and *Quercus vulcanica,* called "Kasnak oak" in Turkish, is an endemic species. Kasnak oak is the East Mediterranean element and is qualified as NT – near threatened – according to the risk categories of IUCN (Ekim *et al.* 2000). The Kasnak oak occurs mainly in Mediterranean Region, in Anatolia mountainous region like in Sultan Mountains (38°29'58"N–31°16'02"E), Kovada-Gökbelenköy Mtn. (37°29'30"N–31°00'04"E) and Karadağ Mtn (36°56'50"N–33°01'39"E) (Fig. 1). The Kasnak oak trees could be found scarcely in some other regions but it formed communities only in these areas. The total area of Kasnak oak in Turkey amounts to 10–12 thousand hectares (Avcı 1996).

The Kasnak oak is one of economic plants in Turkey as it is used in wood industry such as covering, floor parquet, furniture, building material, tool handle, and charcoal (Akman 1995). The tree can reach 27 m in height, its trunk could be *ca* 140 cm in diameter and it can achieve the age of 600 years. Its crown is wide up to 10–12 m (Davis 1982). Several studies have focused on various ecological traits of Kasnak oak (Ocakverdi and Ünal 1991, Kurt *et al.* 1996, Kargıoğlu 2001).

The Kasnak oak has been studied in three localities (Fig. 1) where the well formed communities of this species exist. Kasnak oak forest occurs on limestone bedrock at 1500–1800 m a.s.l. in Sultan Mountains, at 1350–1550 m a.s.l. in Kovada-Gökbelenköy also on limestone bedrocks; and at 1750–2000 m a.s.l. on basalt rocks in Karadağ-Karaman (Fig. 1). In inner Anatolia, Karadağ Mountains chain is of volcanic origin and has a conical shape and the hills and valleys occur at altitudes from 1250 to 2288 m. The moss species, widely accepted as humidity indicator – *Homalothecium sericeum* (Hedw.) Br. – is very common in the Kasnak oak habitat. In the stands of Kasnak oak the following tree

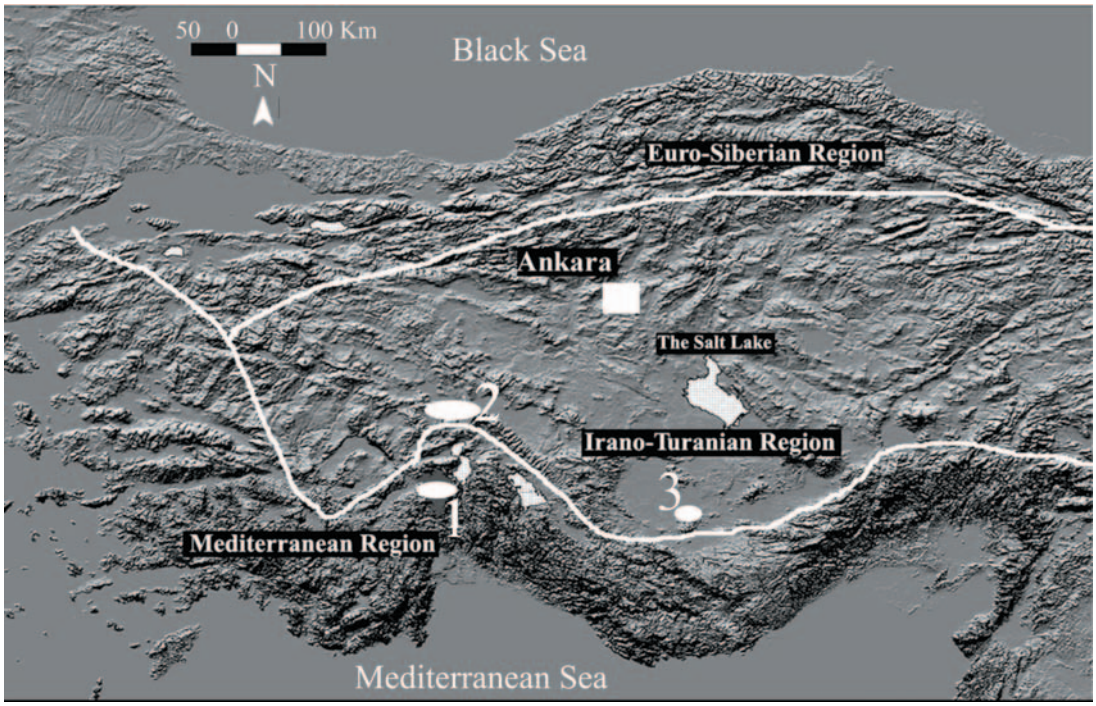

Fig. 1. Extent area of Kasnak oak in Anatolia (Turkey) with three localities of oak forest studies and of meteomonitoring: 1 – Kovada-Gökbelenköy, 2 – Sultan Mountains, 3 – Karadağ

species also occur: *Quercus cerris* L. var. *cerris*, *Q. pubescens* Willd., *Q. trojana* P.B. Webb, *Acer hyrcanum* Fisch. & C.A. Meyer subsp. *sphaerocoryum* Yalt., *A. platanoides* L., *A. tataricum* L., *A. campestre* L., *Sorbus torminalis* (L.) Crantz var. *torminalis*, *Viburnum lantana* L., *Corylus avellana* L. var. *avellana*, *Sambucus nigra* L., *Pinus nigra* J.F. Arnold subsp. *nigra* var. *caramanica* (Loudon) Rehder and *Cedrus libani* A. Rich.

The evaluation of bioclimatic tolerance ranges of Kasnak oak in Turkey was the aim of the study. Several quantitative criteria were used as: the pluviometric quotient, Q_2, according to Emberger (1955, 1971a, b) monthly drought index formula (LDS) according to De Martonne (1948), dry season water deficit (DSWD) according to Gaussen (1954), and the winter variant method suggested by Emberger (1955). All these indices are calculated on the basis of air humidity and winter temperature measurements as suggested by Emberger (1955, 1971a, b).

The study areas were selected and located in three locations described above (Fig. 1), where the Kasnak oak forms the dense communities. The density of trees amounted from 80 to 120 individuals per ha, and their shadows cover percentages varied 80–100% (Avcı 1996).

The climatic data used in this research originated from 19 meteorological stations located nearby the study areas (TMC, 2006). These observations and records were the main source of the climatic data used in this study.

The categories of humidity and the winter conditions are graphically displayed on a 'climagram' (Fig. 2).

According to this classification, two stations (from 19) were in pre-humid, four stations – in sub-humid, eleven stations – in semi arid and two stations – in arid ranges. The winter temperature for 19 stations varied between –6.5 and 0°C. Twelve of them were in very cold, 7 of them – in cold range of temperature.

Duration of the dry season is as follows: in Sultan Mountains – 2–3 months, in Kovada-Gökbelenköy – 1–3 months, and in Karadağ-Karaman – 3–4 months. Dry season water deficit (DSWD) values of the area covered by Kasnak oak communities were following:

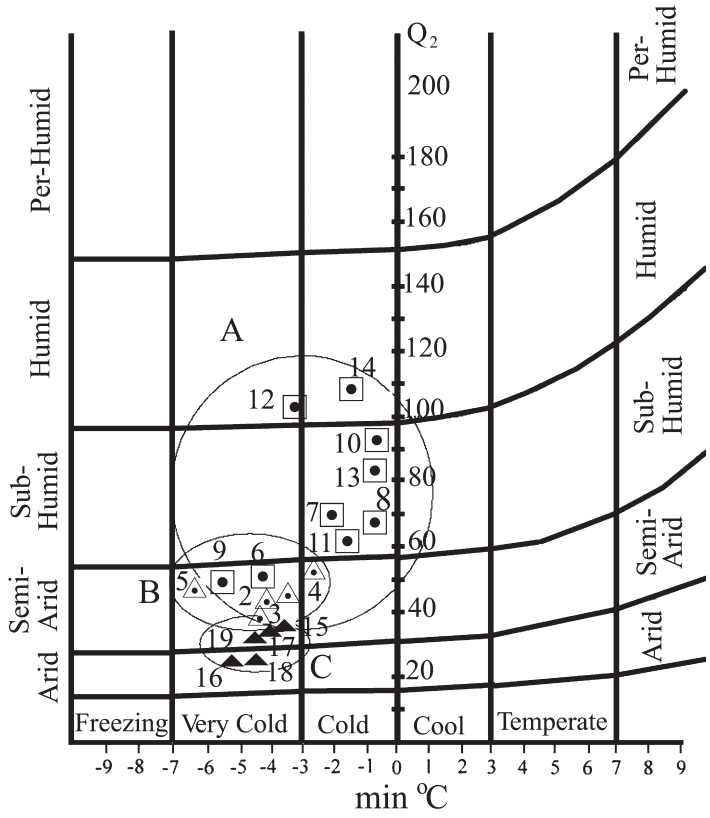

Fig. 2. Emberger's 'climagram' displaying the various types of Mediterranean bioclimates (Quézel and Barbéro 1985) with the field (in circles) covered by the Kasnak oak requirements assessed in three localities (Fig. 1). A: Kovada-Gökbelenköy ⊡, B: Sultan Mountains ◬, C: Karadağ ▲. Q – pluviometric quotient acc. to Emberger (1955). The areas of the circles approximately reflect the abundance of the trees in these localities; the abundance varies from 80 ind. ha^{-1} in C to 120 ind. ha^{-1} in B.

Sultan Mountains – 444 mm, Kovada-Gökbelenköy between -384 and -519 mm, and in Karadağ-Karaman – between -464 and -592 mm.

When the meteorological data from nearby stations of the study areas were applied to the oak communities the following values of average annual temperature and rainfall are observed: 7–9°C and 650–850 mm in Sultan Mountains, 8–10°C and 800–950 mm in Kovada-Gökbelenköy, and 7–8°C and 600–750 mm in Karadağ. These results show that habitat of the Kasnak oak could be ranged from arid, semi-arid, sub-humid to humid conditions. According to classification of winter conditions, it ranges from cold to very cold habitats (Fig. 2).

Specifically, our results showed that optimal annual temperature for Kasnak oak is 7–10°C. Its annual rainfall demand is 600–950 mm. Its bioclimatic classification could be established as humid and very cold. The bioclimatic tolerance range of Kasnak oak is remarkably large as it includes up to 6 different types of Mediterranean bioclimate (Fig. 2). Therefore, the bioclimatic niche of the Kasnak oak in Turkey is characterized by highly heterogenous climate; arid-very cold, semiarid-very cold, semiarid-cold, sub-humid-cold, humid-very cold and humid-cold. Overall results support that Kasnak oak prefers humid conditions in ambient habitat.

The areas of Kasnak oak occurrence should be protected as the areas of nature conservation as it is done in Kovada-Gökbelenköy where Nature Park was established. These kinds of taxa are very rich in Anatolia peninsula and they should be protected and passed to the next generations.

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