An extant disjunct stand of Pterocarya fraxinifolia (Juglandaceae) in the central Zagros Mountains, W Iran 1

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Source: Willdenowia, 33(1) : 113-120

Published By: Botanic Garden and Botanical Museum Berlin (BGBM)

URL: https://doi.org/10.3372/wi.33.33111

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An extant disjunct stand of *Pterocarya fraxinifolia (Juglandaceae)* in the central Zagros Mountains, W Iran[1]

Abstract

Akhani, H. & Salimian, M.: An extant disjunct stand of *Pterocarya fraxinifolia (Juglandaceae)* in the central Zagros Mountains, W Iran. – Willdenowia 33: 113-120. 2003. – ISSN 0511-9618; © 2003 BGBM Berlin-Dahlem.

A stand of *Pterocarya fraxinifolia,* hitherto unknown to science, is reported from the central Zagros mountains in the Irano-Turanian part of Iran, at an altitude of 1730 m, far disjunct from the populations at the Caspian Sea and in the Van area in SE Turkey. It has long been protected by the local people, who believe that cutting these trees is inauspicious. Structure, size and phytogeographical importance of the stand is discussed and its protection, along with nearby gigantic *Platanus orientalis,* as a national natural monument suggested.

Introduction

The forests along the southern shores of the Black and Caspian Seas, which are known as Euxino-Hyrcanian forests, harbour many Arcto-Tertiary relics. Species such as *Quercus castaneifolia* C. A. Mey., *Parrotia persica* (DC.) C. A. Mey., *Acer velutinum* Boiss. and *Gleditsia caspica* Desf. are Hyrcanian elements restricted to the southern coast of the Caspian Sea, phytogeographically described as Hyrcanian Province of the Euro-Siberian Region (Browicz 1989, Akhani 1998, Kürschner & al. 2000). Other species such as *Acer cappadocicum* Gled., *Crataegus microphylla* K. Koch, *Quercus macranthera* Fisch. & C. A. Mey., *Zelkova carpinifolia* (Pall.) K. Koch, *Pterocarya fraxinifolia* C. A. Mey. and *Diospyros lotus* L. (this latter occurs also disjunctly in the Himalaya) are Euxino-Hyrcanian elements, extending further west along the Black Sea. Some authors such as Zohary (1973) consider this area as the Pontic or Euxino-Caucaso-Hyrcanian Province of the Euro-Siberian Region (Frey & Probst 1986) or even of the Sub-Mediterranean Subregion (Meusel & al. 1965). The vegetation of the Hyrcanian parts consists mainly of deciduous forests, below altitudes of 1000 m with thermophilous species such as *Zelkova carpinifolia, Parrotia persica, Diospyros lotus, Pterocarya fraxinifolia, Hedera pastuchovii* Woron. and *Smilax aspera* L.

[1] Notes on the flora of Iran III; the preceding instalment is Akhani & Ghorbani (2003).

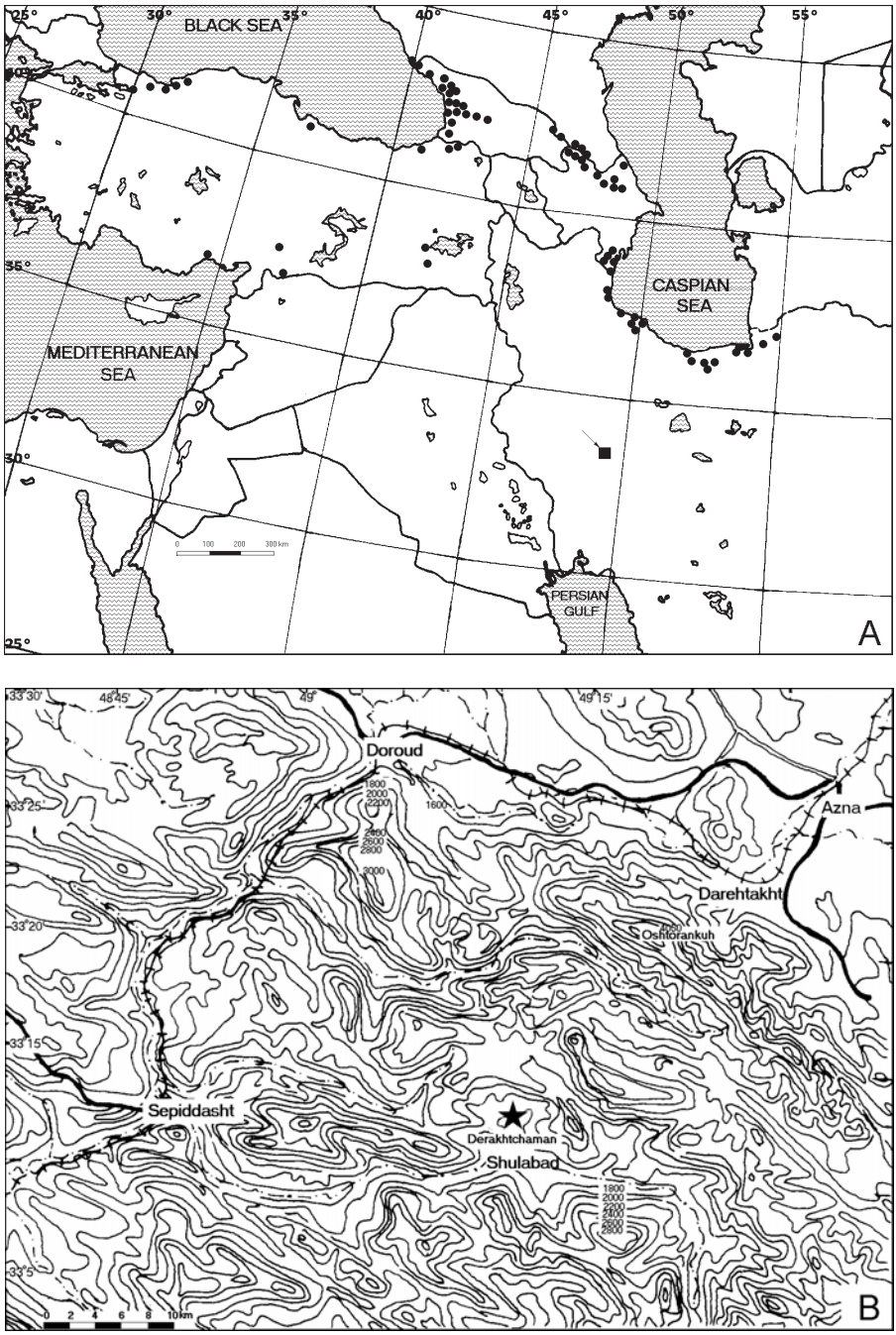

Fig. 1. – A: Distribution of *Pterocarya fraxinifolia* (after Browicz 1982, with new localities added from Kutbay & al. 1999 and herbarium specimens), the new locality in the Zagros Mts indicated by a quadrangle; B: topographic map of the area with the *Pterocarya* stand (★) in the Zagros Mts (redrawn by E. Mohamadzadeh from the Topographic Map of the Iranian Geographical Organization).

Pterocarya fraxinifolia is one of the species previously known only from the Caspian lowland forests, from Caucasus and Anatolia (Boratyński & Boratyńska 1975, Browicz 1976, 1982, Sales & Hedge 1996). During a trip to collect the endemic *Azilia eryngioides* (Pau) Hedge & Lamond *(Umbelliferae),* the second author discovered *P. fraxinifolia* at the small village of Derakhtchaman, on the southern slopes of the Oshtorankuh in the central Zagros Mts (Fig. 1). On 20.8.2001 we made an excursion to study this unexpected discovery of a thermophilous lowland species in a very different altitude and climate. Voucher specimens of these collections are preserved in the herbarium of the Laboratory of Plant Systematics and Plant Geography, Department of Biology of the Tehran University, in the herbarium Berlin-Dahlem (B) and the private herbarium of the first author, with the notation: Lorestan: c. 100 km SWW of Aligudarz, 2 km NE of Shulabad, Derakhtchaman village, riverside, 33°11'05"N, 49°11'38"E, 1731 m, 20.8.2001, *H. Akhani & M. Salimian 15511;* ibid., 7.8.2001, *M. Salimian & M. Mohassel 11.* This paper provides information on the habitat of the Zagros population of *Pterocarya* in comparison with other known populations in the Caspian forests and Turkey, and addresses phytogeographical and conservational aspects.

Habitat, population size and climate

About 150 *Pterocarya fraxinifolia* trees grow densely along 200 m on both river banks in the village of Derakhtchaman (Fig. 1B, 3). The trees are c. 20 m tall, the circumference of one of the older trees is 3 m. They are in good condition, the young twigs and young trees showing vigorous health, and the stands are regenerating. In August, the trees were fruiting, bearing long, pendulous female spikes (Fig. 3B, D). At the southern end of the stand are some trees of *Salix* sp., *Fraxinus syriaca* Boiss. and *Platanus orientalis* L. (Fig. 3F), otherwise no other tree species is associated with *P. fraxinifolia.* The slopes on both sides of the valley are densely covered with *Quercus brantii* Lindl. forest, which is among the most dense and least degraded oak forests of the Zagros Mts.

There are three climatological stations located around Derakhtchaman: Doroud 30 km NW, Darehtakht 30 km NE and Sepiddasht 25 km W (Fig. 1B). Although the precipitation (559.5 mm at Doroud, 586.4 mm at Sepiddasht and 667.7 mm at Darehtakht, Fig. 2) is similar, the temperatures differ between the stations. Doroud and Darehtakht, with a mean daily temperature of 13.9 °C and 10.2 °C respectively, represent a cold steppe climate, whereas Sepiddasht, with a mean daily temperature of 18.8 °C, represents a warmer Mediterranean type of climate (Bayat & Majnoonian 1988). Although Sepiddasht is the station nearest to the higher altitudes with the *Pterocarya fraxinifolia* stand (1730 m), data gained from the local people suggest that the temperature and precipitation records of Darehtakht are more representative. As is evident from the climate diagrams (Fig. 2), both Doroud and Darehtakht have very cold winters, with average minimum temperatures of -4.7 °C and -10.6 °C during January. Frost has been reported from October to April at both stations. According to the local people, much of the winter precipitation is snow, which sometimes covers the area all winter until the end of March. The heavy snowfall of 2001 damaged some of the *Pterocarya* trees.

The altitude and climatic conditions of the known range of *Pterocarya fraxinifolia* along the Caspian and Black Seas are very different to those of the Zagros population. In the Hyrcanian area, *P. fraxinifolia* is a thermophilous tree growing mostly in flooded forests and valleys with running water at an altitude mostly below 1000 m (Browicz 1982). According to Rastin (1983), *P. fraxinifolia* is a character species of the Pterocaryo-Alnetum glutinosae and often associated with *Alnus glutinosa* (L.) Gaertn., *Parrotia persica, Zelkova carpinifolia, Acer velutinum, Carpinus betulus* L. and *Fraxinus excelsior* L. in the forests of the central Caspian coast. The average annual precipitation of the area is 1386 mm and the average annual temperature 14.7 °C. The eastern parts of the range of *P. fraxinifolia* in the Hyrcanian forests receive less precipitation. For example, the annual precipitation of Gorgan, 618 mm, is very similar to that of the central Zagros, but the climate is much warmer, with 17.7 °C annual temperature, -2.4 °C minimum of the coldest month and an absolute recorded minimum temperature of only -9.9 °C (see climate

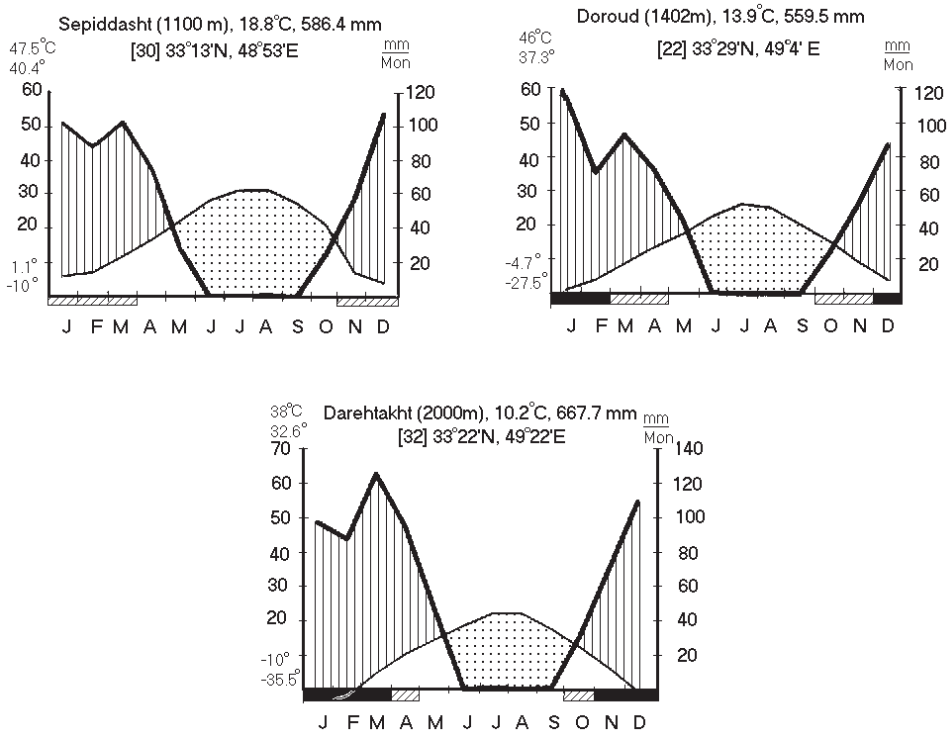

Fig. 2. Climate diagrams of the eastern part of Lorestan Province. – Data from the Iranian Meteorological Organisation, drawn according to the method of Walter (Walter & Breckle 1983).

diagrams in Akhani 1998 and Akhani & Ziegler 2002). Along the Black Sea coast in Turkey the species is found from sea level up to 800 m in the Maraş province in the Aşağı Kerhan (Deretögy), near Kerhan Suyn (Yaltrick 1982). According to Kutbay & al. (1999), *P. fraxinifolia* is a character species of the Pterocaryo-Fraxinetum angustifoliae at Haci Osman flood plain forests in Tekkeköy-Samsun. Here the associated species are mainly *Fraxinus angustifolia* subsp. *oxycarpa, Arum euxinum* R. R. Mill, *Alnus glutinosa* (L.) Gaertn., *Smilax excelsa* L., *Acer campestre* L. subsp. *campestre* and *Ruscus aculeatus* L. var. *aculeatus*. The stands of *P. fraxinifolia* in the Caucasus and SE Turkey, in contrast, are climatically more similar to that of the Zagros Mts than to the Black and Caspian Sea coast.

Naturalness and phytogeographical significance

According to the local community, the *Pterocarya fraxinifolia* trees grow here with living memory and the belief that cutting is inauspicious has preserved them to the present. In contrast to most stands of *Pterocarya* in the Caspian lowlands, the Zagros stand is very compact with a closed canopy. In the understorey no other woody or herbaceous plants occur, except *Cuscuta* sp. parasiting on young twigs. The pure stand may thus be considered the result of human cultivation, but actually it is more likely the result of root propagation, which is a common reproduction mode of this species in the Caspian forests (Rastin 1983, Browicz 1982). The origin of the trees from a population outside the area (i.e. from the Caspian Sea) is unlikely, because *P. fraxinifolia* trees have not the economic value to bring them over a considerable distance to an isolated mountain village in Lorestan. Actually, nowhere in Iran the species is cultivated.

Fig. 3. *Pterocarya fraxinifolia* in the village of Derakhtchaman – A, C: dense population along the river with the *Quercus brantii* forest of the surrounding mountains in the background; B, D: fruiting spikes; E: view of the village; F: old *Platanus orientalis* tree with seven trunks just near *P. fraxinifolia.*

With its predominantly Euxino-Hyrcanian distribution (Fig. 1A) *Pterocarya fraxinifolia* is known as a classical example of an Arcto-Tertiary relic element growing in the lower-altitude forest of the Hyrcanian and Euxinian provinces of the Euro-Siberian Region (Zohary 1973, Browicz 1989, Frey & al. 1999). The present findings and the occurrence of the species in the Irano-Turanian parts of southeastern Turkey show that the species has a wider range in the Irano-Turanian Region. Fossils and pollen of *P. fraxinifolia* or of the related extinct *'P. limburgensis'* were known through the Tertiary, from the Miocene to the latest Pliocene. It was particularly widely distributed in the interglacials of the Upper and Middle Pleistocene. During the beginning of the Quaternary period, representatives of this species group were still found in Europe north of the Alps (Traulau 1963, Probst 1981, Lang 1994, Leory & Roiron 1996).

The present stand of *Pterocarya fraxinifolia* in the central Zagros Mts can be considered a remnant population, which has been able to survive in the suitable climatic condition of the area by vegetative reproduction via root propagation. However, a final judgement requires further studies in the area.

Van Zeist & Bottema (1977) found no pollen records of *Pterocarya* from the Pleniglacial to post-glacial sediments of the Zeribar and Mirab lakes in western Iran. Palynological studies show that the present-day Zagros oak forests *(Quercus brantii)* were established c. 5500 BP, after the unfavourable drier climatic conditions of the Pleniglacial and Lateglacial. According to pollen assemblages, the climate of the Zagros Mts during the Lateglacial was dry and cold and vegetation was dominated by *Artemisia* and *Chenopodiaceae* (Van Zeist & Bottema 1977, Stevens & al. 2001). However, this interpretation was not accepted by El-Moslimany (1987, 1986), who assumes that the Pleistocene environment of the area may have been similar to that of the recent tragacanthic or alpine belt of the Zagros Mts. She explains that the dominance of *Chenopodiaceae* and *Artemisia* pollen was caused by the low productivity of high-altitude vegetation, preferential incorporation of pollen of late-blooming plants into the sediments, high productivity and long-distance transport of lowland pollen. In favour of El-Moslemany's criticism, we believe that high percentage of *Artemisia* and *Chenopodiaceae* pollen is not essential as indicator of a dry climate. There are extensive *Salicornia* populations around the south-central Iranian salt lakes and depressions in the Fars province. There are even some *Artemisia* species (*A. aucheri* Boiss.) that are dominant in the higher altitudes of Iranian mountains with cold climatic condition (own observation, Podlech 1986). Even during the drought period there were some places where trees survived in refugia (Van Zeist & Bottema 1977). In a study of post-glacial pollen assemblages from Lake Van in eastern Turkey, Van Zeist & Woldring (1978) demonstrated the occurrence of 4-5 % values for *Quercus* pollen. They mentioned that oak stands occurred in edaphically favourable habitats, such as sheltered valleys with somewhat moister soil due to accumulation of run-off water. Bottema (1986) reported low values of *Pterocarya* pollen in the Lake Uromia assemblage but assumes that the pollen had its origin in the Caucasus mountains. The modern dispersal of *Pterocarya* pollen from Caspian origin in the Turan area, located in the north-central Iranian Great Kavir, was demonstrated by Moore & Stevensen (1982).

The occurrence of some Euxino-Hyrcanian species in the Zagros Mts indicates closer phytogeographical links and ancient floristic connection between these areas. *Zelkova carpinifolia* is another Euxino-Hyrcanian species with a distribution range somewhat similar to that of *P. fraxinifolia* and is also disjunctly known in the Zagros Mts (Sabeti 1976, Browicz 1982: map 100). The occurrence also of several isolated endemic species in southwestern Iran, such as *Azilia eryngioides* Hedge & Lamond and *Haussknechtia elymaitica* Boiss., representing unispecific *Umbelliferae* genera, indicates furthermore an old floristic stock in the area.

Etymology, conservation and economic uses

The vernacular name of *Pterocarya fraxinifolia* in Derakhtchaman is "Rahmani". This has an Arabic root and means "god's gift". The name of the village of Derakhtchaman ('Derakht' means tree and 'Chaman' meadow or green cover) apparently refers to the dense *Pterocarya* population. Close to the *Pterocarya* stand there is a giant *Platanus orientalis* tree with seven

separate trunks (Fig. 3F). The circumferences of five trunks were measured as 4.75, 3.94, 3.5, 3.5 and 3 m, respectively. Similar to *P. fraxinifolia,* the *Platanus* trees have been protected by the local community up to date. In view of many recent examples where both old trees and important natural ecosystems have been damaged or destroyed, the *Pterocarya* stand and associated trees urgently need protection through national law. We suggest that the Oshtorankuh Protected Area should be extended to the southern slopes so to include the village Derakhtchaman. The *Pterocarya* stand and associated trees additionally should receive the status of a "National Natural Monument".

Pterocarya fraxinifolia is a beautiful tree and because of its wide crown, pendulous fruiting spikes and large pinnate leaves also an attractive garden and street plant. The species has long been cultivated in European gardens (Wijnands 1989), but not in Iran. The trees are physiognomically very similar to *Ailanthus altissima* and can be a substitute for this Chinese species, which is now widely cultivated in Iran and causes ecological problems in some areas. The discovery of the Lorestan population adds to the genetic diversity of *Pterocarya.* Being more resistant to cold as the coastal populations, the newly discovered stand is a potential source of a new cultivar. Molecular research to elucidate the genetic divergence of the Lorestan population from those of the other areas would be rewarding.

Acknowledgements

We thank the Iranian Meteorological Organization for providing us the climatic data, Prof. E. Box (Georgia, Athene) for improving the English text, Ms Mohamadzadeh for drawing Fig. 1B, and the research deputy of the Tehran University for supporting this study under grant No. 513/4/608.

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