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RESEARCH PAPER

Human and natural degradation of euphrates poplar (*Populus euphratica* Oliv.) stands in Iran

Hossein Tavakoli Neko[*1], Anoushirvan Shirvany[2], Mohammad Hassan Assareh[3], Mohammad Reza Naghavi[4], Mohammad Pessarakli[5]

[1]*Forests and Rangelands Research Department, Qom Agricultural and Natural Resources Research and Education Center, AREEO, Qom, Iran*

[2]*Faculty of Natural Resources Sciences, University of Tehran, Karaj, Iran*

[3]*Research Institute of Forests and Rangeland, Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran*

[4]*Faculty of Agricultural Sciences, University of Tehran, Karaj, Iran*

[5]*School of Plant Sciences, The University of Arizona, Tucson, Arizona, USA*

Abstract

This study was carried out in 2014-2015 to evaluate the genetic diversity of Euphrates poplar *Populus euphratica* populations in some natural habitats in Iran. *P. euphratica* trees with relatively high resistance to environmental stress such as drought, salinity, heat and cold conditions. It has been able a unique ecological and environmental effects in different areas of arid and semi-arid climate. The trees on the river margin have been challenged with the development of agricultural land and unfortunately, some farmers have been eradicated them. Also presence of livestock in natural stands of these trees can disrupt regeneration and they will not be able to revitalize, thus they destroying in the next time. The other factor threatening them is the timber felling of trees for firewood and woody needs by villagers. One of the important Euphrates poplar stands in Iran that go to extinction is Gherkhlar, Marand in East Azerbaijan province of Iran. Unfortunately the Euphrates poplar trees with old age due to poor habitat and human threats cannot revitalize and endangered extinct.

*Corresponding Author: H. Tavakoli-Neko ✉ Tavakolineko@yahoo.com

Introduction

Salinization of land and water resources, soil erosion, deforestation and range lands destruction, reduce the production of arable land, and destroying vegetation are aspects of the Land degradation (Zhenda *et al.*, 1988). Initial civilizations were developed based on agriculture, in some cases these civilizations were destroyed due to improper application of land use and the subsequent loss of soil fertility and the failure of agriculture (Malakouti *et al.*, 2003).

The Euphrates Poplar (*Populus euphratica* Olive.) is a medium-sized deciduous tree that may grow to a height of about 15 m and a girth of 2.5 m where conditions are favorable. The stem is typically bent and forked; old stems have thick, rough, olive-green bark. While the sapwood is white, the heartwood is red, darkening to almost black at the center. The roots spread widely but not deeply. The leaves are highly variable in shape. It is used in agroforestry to provide leaves as fodder for livestock, timber and, potentially, fiber for making paper. It is also used in afforestation programs on saline soils in desert regions, and to create windbreaks and check erosion. The bark is reported to have anthelminthic properties (Rae *et al.*, 2003). This species has a very wide range, occurring naturally from North Africa, across the Middle East and Central Asia to western China. It may be found in dry temperate broadleaf and mixed forests and subtropical dry broadleaf forests at altitudes of up to 4000 m above sea level. It is a prominent component of floodplain ecosystems along river valleys in arid and semi-arid regions. It grows well on land that is seasonally flooded and is tolerant of saline and brackish water. Much used as a source of firewood, its forests have largely disappeared or become fragmented over much of its natural range (Phan *et al.*, 2004). *P. euphratica* Oliv. can be grown in arid areasand is resistant to considerable amounts salt in the soil, but is sensitive to water deficit, frost and pests (Ottow *et al.*, 2005). In field conditions seedlings deaths is happening in elementary aged in loam and sandy soil. The trees often seen around the springs, rivers and valleys and areas exposed to potential floods (Khamzina *et al.*, 2006).

P. euphratica Oliv. is a unique woody species which is naturally distributed in desert areas of some parts Asia and Africa. Because of its outstanding features, it is a model plant to study environment stress tolerance (Wang *et al.*, 2011).

This research was conducted to evaluate the genetic variation in populations of *Populus euphratica* Oliv. in Iran and find the habitats at risk and recommending it to government agencies for scheduling their protection.

Materials and methods

Study area

In order to identify and evaluate main habitat of *P. euphratica* in Iran, we refer to some regions in Iran. In this study to assess the different populations of *P. euphratica* referred to areas in the Khuzestan in southwestern of Iran, Azerbaijan in northwestern of Iran, Gilan in northern of Iran, Golestan in northeastern of Iran, Khorasan in eastern of Iran and Qom, Isfahan and Markazi in central of Iran; the data summarized and show in Table 1. We focus on Ghelekhlar stand in Azarbayjan of Iran that is an ancient habitat with anthropogenic degraded (Fig. 1).

Table 1. Geographical position of the regions sampling.

No.	Site	Latitude	Longitude	Altitude
1	Mahalat	E 50 33	N 34 00	1850 M
2	Hamidi-eh	E 48 28	N 31 31	0023 M
3	Hamid abad	E 48 20	N 32 14	0063 M
4	DashliBorun	E 54 54	N 37 46	0037 M
5	Neyzar	E 50 36	N 34 23	1198 M
6	Ghelekhlar	E 45 24	N 38 31	1077 M
7	Jolfa	E 45 41	N 38 57	0703 M
8	Gilavan	E 49 15	N 36 46	0376 M
9	Manjil	E 49 26	N 36 15	0330 M
10	Maranjab	E 51 40	N 34 13	0930 M
11	Sarakhs	E 61 09	N 36 18	0330 M

Traits assessment

Geographic and ecologic characteristics of trees and native vegetation were recorded. In each habitat features such as rainfall and other water conditions and soil characteristics were recorded. The characteristics of the tree such as trunk diameter, tree height, crown dimensions

size and shape of leaves and petioles and breeding and regeneration status were recorded.

Fig. 1. Site study (Ghelekhlar village) on Iran map.

Molecular assessment
In order to study the molecular diversity, leaf samples were taken from five trees with the greatest possible distance. To evaluate the variation within populations, 10 primer pairs of SSR markers were used. The selected Primer sequences used for the amplification of DNA template was used Tavakoli *et al.*, (2016).

Data analysis and statistical calculations
SSR data were analyzed using Gen ALEx 6.1 software. According to this analysis features such as alleles number (Na), effective alleles number (Ne), Shannon's information index (I), observed heterozygosis (Ho), expected heterozygosis (He), coefficient of deviation from Hardy-Weinberg's equilibrium were calculated.

Results and discussion
Populus euphratica. had covered widely from different parts of Iran in the past, but today, most of their dense cover is lost and often the scattered trees remain beside rivers and waterways and areas with high groundwater levels (Sabeti, 1994). In this research was also observed elimination of some Euphrates poplar habitats. Geographic and climatically difference in habitats affected on morphological and genetic diversity among the different populations (Calagari, 2005). It seems that this genetic variation can serve as a valuable reserve for genetic screening for selecting and breeding trees resistant to environmental stress conditions.

Molecular analysis
In this study numbers of alleles observed in Ghelekhlar population (Na) was 4.9 and numbers of effective alleles (Ne) was 4.17, these were lower than average in other populations that were 6.43 and 5.58 respectively. The observed heterozygosis (Ho) in Ghelekhlar was 0.61 and expected heterozygosis (He) was 0.73, these were lower than average in other populations that were 0.65 and 0.80 respectively. Shannon's information index (I) in this population was 1.46 and this lower than average in other populations that was 1.75 (Table 2). Of course, for all populations Shannon's information index (I) in this study was lower than that reported by Wang *et al.* (2011) in northwest China. The decreased diversity is possibly due to the smaller stands in Iran compared to those in China.

Table 2. Genetic variation within population of *P. euphratica* based on SSR loci.

Population	Na	Ne	I	Ho	He	F
Ghelekhlar	4.90	4.17	1.46	0.61	0.73	0.16
Mean	6.43	5.58	1.75	0.65	0.80	0.19

Ne = No. of effective Allels, I = Shanon, Information Index, Ho = Observed Heterozygosity, He = Expected Heterozygosity, F = Fixation Index.

Fig. 2. Eradication and burning the trees in site study.

The results showed deviation from Hardy-Weinberg's equilibrium in of Ghelekhlar population. The reasons for deviation from Hardy-Weinberg's equilibrium in this population can be due to smaller size and purity of the stand and lack of regeneration of the trees in that site.

Discussion

The Ghelekhlar region is located on 32Nd kilometer of Marand-Khoye road in northwest of Iran. In that region there are many elder trees that constituted relatively large stands. The trees' age estimated about 300 years. Because of over grazing and several flood situations in this region, tree seedling crop did not observe and root sucker or sprout was Rare and coppice regeneration was very low.

Elder trees in the area and the effects of their destruction by anthropogenic factors, including robust logging, grazing and insect attack were observed (Fig.2).

Suggestion

Due to the unique conditions of Euphrates poplar trees in the area and destroying rate these trees is recommended that this region determine as genetic reserves of Euphrates poplar and be considered as protection and support area.

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