IAWA Journal, Vol. 30 (1), 2009: 81–86

ELEMENTARY SOFTWARE FOR THE HAND LENS IDENTIFICATION OF SOME COMMON IRANIAN WOODS
Short Communication

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SUMMARY

A computer program, "Hyrcania", has been developed for identifying some common woods (26 hardwoods and 6 softwoods) from the Hyrcanian forest type of Iran. The program has been written in JavaScript and is usable with computers as well as mobile phones. The databases use anatomical characteristics (visible with a hand lens) and wood colour, and can be searched in English or Persian. Descriptions and images can be retrieved by their scientific name.

Key words: Wood identification, computerized program, Iranian hardwoods, lens.

INTRODUCTION

Iran has a history of civilization going back over 5000 years. A simple technique for wood identification would be valuable at many of its historical sites. Although some research has been done in Iran on microscopic characteristics of Iranian wood (Hejazi 1978; Schweingruber & Parsa-pajouh 1993), a key for macroscopic identification of Iranian wood has not been prepared. There is information available on odour, colour and texture of woods (Niloufari 1985; Aghajani & Poor-Moradi 1995). Hejazi (1978) described the simple gross structure of wood as well as the microscopic structure of north Iranian timbers, but he did not describe their macroscopic structure. Niloufari (1985) wrote a bilingual book about characteristics of native and exotic woods. Toghraie *et al*. (1999) developed software to assist with wood structure-property research as well as microscopic identification of Iranian wood.

Because of the different climates in the five regions of Iranian forests: Hyrcanian, Iran-toran, Zagros, bank of Persian Gulf and Oman, many different species of trees and shrubs occur. The purpose of this paper is to introduce "Hyrcania software" which was developed to assist in hand lens identification of Iranian woods from the Hyrcania region. The users of this software need a basic knowledge of wood anatomy.

MATERIALS AND METHODS

To develop the database for macroscopic characteristics of Hyrcanian species, three mature trees of each species were selected and one disc (cross section) at breast

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Table 1. Macroscopic features of Iranian hardwoods used with computer software Hyrcania.

Species	Porosity	Ray visibility	Growth rings	Tyloses	Axial parenchyma	Vessel arrangement	Vessel grouping
Albizzia julibrissin	Ring	–	+	–	V & M & A & C	DR	RL & RM
Fraxinu excelsior	Ring	–	+	+	V & M & A & C	DR	RL
Quercus castaneaefolia	Ring	+	+	+	BP & V & Dif	DP & DR	ES
Robinia pseudoacacia	Ring	+/–	+	+	A & C & M	TB	CC
Morus alba	Ring	+	+	+	V & C & A	TB	CC
Gleditsia caspica	Ring	+	+	–	V & A & C & M	TB	CC
Celtis australis	Ring	+	+	+/–	V & C & M	TB	CC
Ulmus campestris	Ring	+	+	+/–	V & C & M	TB	CC
Ulmus glabra	Ring	+/–	+	+/–	V & C & M	TB	CC
Zelkova carpinifolia	Ring	+	+	+/–	V & C & M	TB	CC
Acer insigne	Diff	+	+	–	AB	DR	RL
Alnus subcordata	Diff	+/Agg	+	–	AB	DR	RM
Carpinus betulus	Diff	+/Agg	+	–	BP	DR	RM
Buxus hyrcana	Diff	–	+	–	AB	DR	ES
Parrotia persica	Diff	–	+	–	BP & Dif	DR	ES

(continued on next page)

(Table 1 continued)

Species	Porosity	Ray visibility	Growth rings	Tyloses	Axial parenchyma	Vessel arrangement	Vessel grouping
Diospyrus lotus	Diff	–	–	–	BP & V & Dif	DR	RL
Juglans regia	Semi	–	+	+/–	BP & Dif	DR	RL
Pterocarya fraxinifolia	Semi/Diff	–	+	+/–	BP & Dif	DR	RL
Ficus carica	Diff	–	+/–	+/–	BP & C & M	DR	RL
Fagus orientalis	Diff	+	+	–	AB	DR	CC
Platanus orientalis	Diff	+	+	–	AB	DR	CC
Populus nigra	Diff	–	+	–	AB	DR	CC & RL
Prunus avium	Semi/Diff	+/–	+	–	AB	DR	RM & CC
Prunus divaricata	Semi/Diff	+	+	–	AB	DR	RL & CC
Sorbus torminalis	Semi/Diff	+/–	+	–	AB	DR	RM & CC
Tilia rubra	Semi/Diff	–	+	–	AB	DR	RL & RM & CC

Porosity: Ring = ring porous ; Semi /Diff = semi-ring porous or diffuse porous ; Diff = diffuse porous. — Rays: + = visible without lens; – = invisible without lens ; +/– = visible or invisible without lens; +/Agg = visible without lens and aggregate. — Growth rings: + = distinct; – = indistinct; +/– = distinct or indistinct. — Tyloses: + = present; – = absent; +/– = present or absent or very sparse. — Axial parenchyma: A = aliform; AB = absent or extremely rare; BP = banded parenchyma; C = confluent; Dif = Diffuse in aggregates; M = marginal or seemingly marginal bands; V = vasicentric. — Vessel arrangement: DP = dendritic pattern; DR = diagonal and/or radial pattern; TB = tangential bands. Vessel grouping: CC = clusters common; ES = exclusively solitary (90 % or more); RM = radial multiple of 4 or more common; RL = radial multiple fewer than 4 common. — The shaded species are similar in macroscopic appearance.

height was cut from each tree. Leaves and fruits were deposited in the herbarium of the Islamic Azad University of Iran (Karaj Branch). The samples chosen were sound and without defects such as reaction wood, juvenile wood, knots, decaying and spiral grain, as recommended by Hoadley (1980, 1990). The samples were moistened and were cut to produce a smooth, flat and clean surface, devoid of cell damage. Cleaning and clearing the surface is important and sandpaper was not used to avoid filling vessels with sawdust.

To help make longitudinal parenchyma and especially ring boundary features more obvious, chalk (as is used on blackboards) was applied to the cross section, then cleaned with a sponge. Cross sections of samples were photographed at different magnifications (10×, 20×, 30× and 40×). The IAWA Lists of microscopic features for hardwood and softwood identification were consulted (IAWA Committee 1989, 2004); we added a vessel grouping category (vessels solitary and radial multiples fewer than 4 common). Software has been written with JavaScript and students can easily use the program with a pocket cell phone. The software has been written in two languages (English and Persian), and after opening the software on the computer, the language can be selected.

Table 2. Macroscopic features of Iranian softwoods used with computer software Hyrcania.

Species	Resin canals
Taxus baccata	Absent
Juniperus polycarpos	Absent
Thuja orientalis	Absent
Cupressus sempervirens	Absent
Picea excelsior	Present
Pinus eldarica	Present

The shaded species are similar in appearance. Resin canals of *Picea excelsior* are small and relatively few, with variable distribution and even absent in some tree rings, but in *Pinus eldarica* they are large, numerous and evenly distributed.

RESULTS AND DISCUSSION

The databases for the Hyrcanian woods are shown in Tables 1 and 2. Once the program is started, questions are presented and the user answers the questions one by one. For any answer the software automatically eliminates all species that do not agree with the answer.

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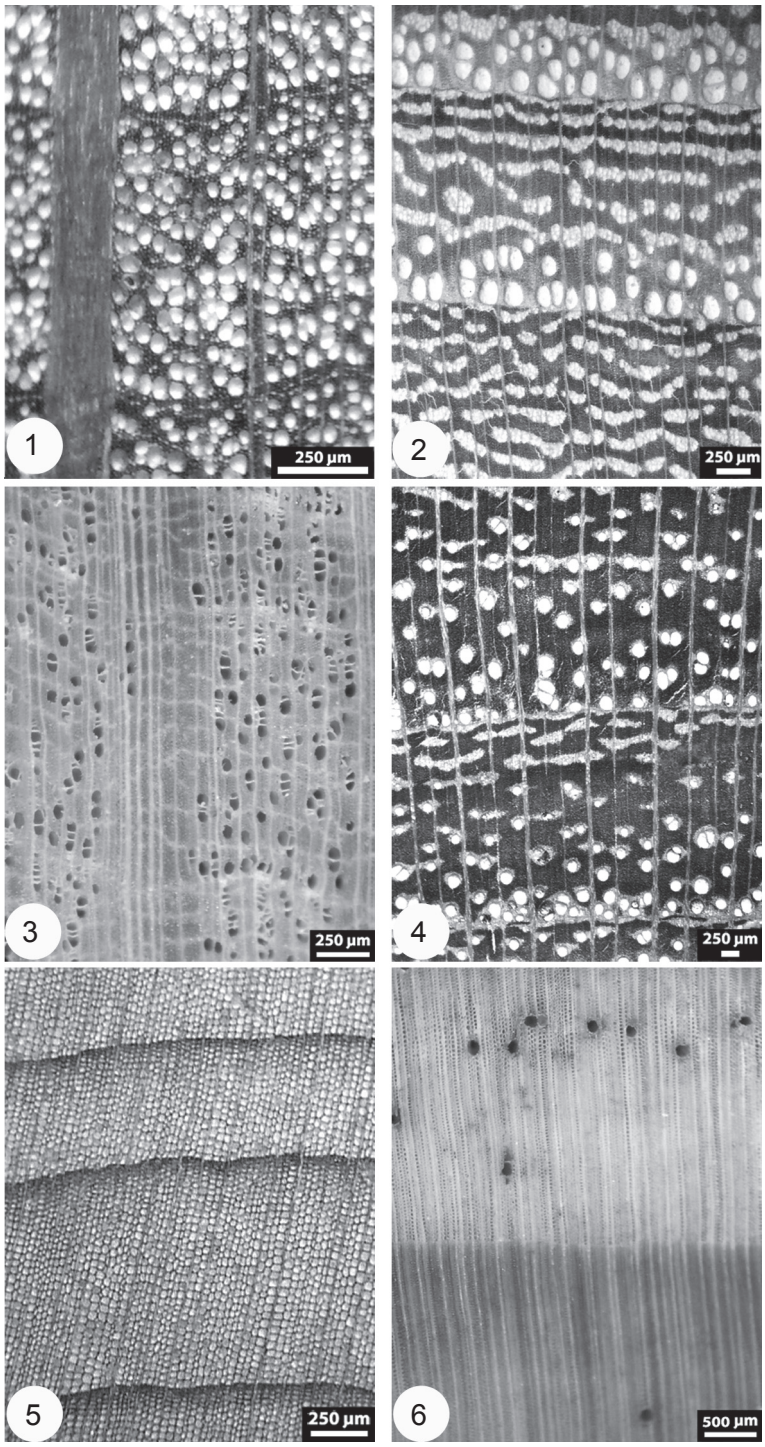
Figures 1–6. Examples of cross sections of Iranian hardwood species. – 1: *Fagus orientalis*. – 2: *Ulmus glabra*. – 3: *Carpinus betulus*. – 4: *Gleditsia caspica*, an indigenous species of the Hyrcanian zone of Iran. – 5 & 6: Cross sections of Iranian softwoods; 5: *Taxus baccata*; 6: *Pinus eldarica*, an exotic species widely planted in Iran.


1
250 µm
2
250 µm
3
250 µm
4
250 µm
5
250 µm
6
500 µm

The program starts with the choice:

1. Vessels present or vessels absent

If vessels are present options can be selected from Table 1. If vessels are absent, options can be selected from Table 2. After all the questions have been answered, the software usually yields two or three names of woods. Similar appearing woods are shaded in Tables 1 and 2. The user can click on the name of the wood to see colour photos (examples shown in Figures 1–6 in black and white) and can use the colours and patterns (such as ray flecks in beech and oak, or undulating tangential bands in elm) in the photos to help make the identification.

At the university, wood identification was previously taught by traditional methods using only descriptions, wood colour, and photos, and students found this method tedious. However, the use of computers in laboratory classes and mobile phones in the field made wood identification interesting for the students, and after a short time they usually became able to identify these common woods without computerized programs.

ACKNOWLEDGMENTS

The authors thank the reviewers for their valuable comments. The information about species in the "InsideWood" website (http://insidewood/lib.ncsu.edu/search) was very helpful.

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