A contribution to the natural distribution of *Aesculus hippocastanum* (*Hippocastanaceae*) in Greece

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Abstract. Horse chestnut (*Aesculus hippocastanum*) is an endemic species to Greece. The information on its natural distribution in Greece is limited. After a destructive primary pest of horse chestnut, the leaf miner *Cameraria ohridella*, has spread in recent years almost all over Europe, much attention has been focused on the natural gene pool of the host. In a study of its distribution in Greece during the period 2001-2004, we found 37 new scattered locations of natural trees, in small or large clusters and in mixed stands with beech (*Fagus sylvatica*), dominating and covering an area of 750 ha. Horse chestnut in Greece shows remarkable habitat adaptability, as it occurs in a wide range of altitudes from 228 m to 1485 m a.s.l.

Keywords: *Aesculus hippocastanum*, Greece, natural distribution

Introduction

Horse chestnut (*Aesculus hippocastanum* L.) is a vigorous deciduous tree, indigenous to the Central Balkan Peninsula. It is easily found in Albania, Central and Northern Greece, the Former Yugoslavia (Greuter & al. 1986; Polunin 1997), as well as in a restricted area in East Bulgaria (Ball 1968). In 1576 it was carried over to Vienna, via Constantinople (nowadays Istanbul, Turkey), and from there to Central and Western Europe (Krüssmann 1976). About the same period Mattioli took it to Italy, again via Constantinople, where it became a favorite tree for parks, gardens and boulevards across the Italian Peninsula, at altitudes up to 1300 m (Pignatti 1982).

The natural occurrence of horse chestnut in Greece is restricted to the Pindos Mountain Range in the regions of Epirus (NW Greece) and Thessaly (Central Greece) as well as in the southernmost counties of Evrytania and Fthiotida (Heldreich 1980; Aas & Riedmiller 1992; Boratynski & al. 1992; Tsalikides 1994; Strid & Tan 2000). According to Horvart & al. (1974), horse chestnut can grow in moist but well drained stony soils of Central and Northern Greece, Albania and Former Yugoslavia at altitudes from 380 m to 1330 m. According to Raus (1980), such microhabitat features are crucial for the formation of the plant community *Aesculus hippocastanum-Tilia platyphyllos* on the NE aspect of Mount Ossa (East Central Greece). Finally, Hanlidou & Kokkini (1997) considered that the presence of some trees of the Balkan pa-

laeoendemic *A. hippocastanum* was of special phytogeographical interest.

Molecular data (chloroplast and nuclear ribosomal RNA genes) combined with the current geographical distribution of genus *Aesculus* were used to determine the origin of that genus. Within phylogenetical scope and with application of a molecular clock, the origin of the genus was traced back about 65 million years (Late Creataceous – Early Tertiary), at a high latitude in E Asia. Thereafter, it spread as an element of the "boreotropical flora" into N America and SE Europe, while the current erratic distribution of the genus results from the geological and climatic changes that occurred during the Tertiary Period (Xiang & al. 1998).

In regard to the economic importance of horse chestnut apart from wood production and its value as an amenity tree, it is important for its pharmaceutical uses. Ingestion of any part of the horse chestnut may cause mild stomach upset (Brickell 1999). Aescin, the major active substance extracted from the seeds of *A. hippocastanum*, is widely used for medicinal as well as cosmetic preparations (Bellini & al. 1996; Matsuda & al. 1997; Sirtori 2001). Its particular application for chronic venous insufficiency (Sahelian 2001) and treatment of such problems as phlebitis, inflammation of the veins, varicosity, hemorrhoids and leg ulcers has enhanced interest in its cultivation in recent years.

In the last 15 years a destructive primary pest, the leaf miner *Cameraria ohridella* Deschka & Dimic (*Lepidoptera, Gracillariidae*), has spread almost all over Europe devastating the foliage of the trees and causing terrible problems in gardens, boulevards and parks. As application of chemical control in urban areas is impossible, research is oriented toward finding resistance, which can be promising with a known natural gene pool of the host. The objective of our work was to study the natural distribution of horse chestnut in Greece.

Material and methods

Visits to different parts of the country were organized based on the existing information in literature and information provided by the Greek Forest Service. Each location where horse chestnut trees were found was described in detail, both geomorphologically and sylviculturally, while coordinates were taken with a GPS apparatus "e-Map" made by GARMIN USA. Distribution data in Fig. 1 appear in WWS. In all cases, particular care was taken to ensure that all recorded trees were natural and not planted.

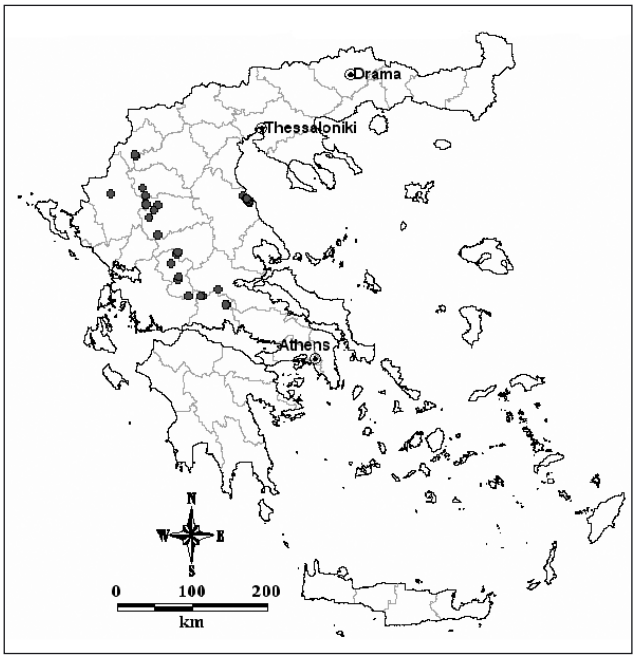

Fig. 1. Natural distribution of *A. hippocastanum* in Greece.

Results and discussion

During the four years of investigation, 37 new and distinct locations with natural horse chestnut were found. As can be seen in Fig. 1, the natural distribution of horse chestnut in Greece is limited along the north-south axis following the Pindos Mountain Range and ending at its southern end at Mt Vardousia. A unique exception is a location found on Mt Ossa, on the eastern coast. The wide range of altitudes where natural trees were found (228 to 1485 m) shows that *A. hippocastanum* has an exceptional ability for habitat adaptation (Table 1).

The number and the size of the horse chestnut trees occurring in the 37 locations varied remarkably. We found isolated and scattered trees, small or large clusters, and also mixed stands with beech (*Fagus sylvatica* L.) as dominant species in the forest in Ondria (NW Greece) in the Pindos Mountain Range. Table 2 shows the diameters of the recorded trees which ranged from several cm to over 100 cm in the mixed stands. Another important point was regeneration, witnessed in almost every location.

Table 1. Geographical data of the locations with recorded natural occurrence of *A. hippocastanum*. Locations marked with an asterisk (*) fall within the boundaries of protected areas.

Location no.	Location name	Longitude (East)	Latitude (North)	Altitude (in m)
1	Gavroneri, Stomio (Co Larisa)*	022 40 821	39 52 180	228
2	Dragasia-Gravalo Pezouli-Megali Ondria (Co Kozani)	021 06 457	40 19 944	1.386
3	Gefira Papakou, Karitsa (Co Larisa)	022 43 381	39 50 973	566
4	Kalomoira, Paliochori (Co Trikala)	021 25 071	39 45 071	658
5	Arkoudopouri, Melivia (Co Larisa)*	022 45 966	39 48 874	675
6	Kakoskali (Co Larisa)*	022 46 724	39 48 010	696
7	Geka, Melivia (Co Larisa)*	022 46 386	39 48 585	697
8	Kakoskali, Melivia (Co Larisa)*	022 46 835	39 47 995	706
9	Gomarolakas-Asfalto (Co Larisa)*	022 43 053	39 50 743	732
10	Vromoneri-Evrimenon (Co Larisa)*	022 42 819	39 50 665	787
11	Dasos Nanitsa (Co Trikala)	021 22 567	39 42 377	808
12	Perivoli (Co Grevena)*	021 12 242	39 57 932	816
13	Katavothra-Evrimenon (Co Larisa)*	022 42 583	39 50 348	834
14	Pouri Artotinas, Lidoriki (Co Fokida)*	022 03 839	38 43 013	901
15	Kalliroi, Koukoufli (Co Trikala)	021 18 211	39 37 246	909
16	Kranea-Milea (Co Grevena)	021 14 979	39 52 744	923
17	Dasorema-Desi Kolovogianni (Co Fokida)*	022 05 178	38 43 717	926
18	Tzamia-Evrimenon (Co Larisa)*	022 42 465	39 50 179	947
19	Malakasi-Routzi (Co Trikala)	021 15 281	39 46 437	957
20	Megali Loga, Lidoriki (Co Fokida)*	022 05 037	38 43 384	962
21	Gomarolakas-Evrimenon (Co Larisa)*	022 43 648	39 50 050	975
22	Rema Skorda-Evrimenon (Co Larisa)*	022 44 564	39 49 561	992
23	Vathirema (Co Trikala)	021 25 849	39 25 418	1.039
24	Lake Plastira (Co Karditsa)	021 43 839	39 13 708	1.061
25	Vaeni-Dasos Malamouli (Co Karditsa)*	021 42 875	39 12 840	1.082
26	Pano-Kalesmenou (Co Evrytania)	021 43 471	38 54 527	1.105
27	Platanolaka-Kalesmenou (Co Evrytania)	021 44 758	38 56 655	1.141
28	Mariolata Forest-Rocks (Co Fokida)	022 25 375	38 37 345	1.161
29	Megalo rema, Nafpaktos (Co Aetoloakarnania)	021 52 136	38 43 769	1.229
30	Mariolata Forest-Efkero Sakkouli (Co Fokida)	022 26 560	38 37 751	1.237
31	Prionia Stangogianni, Malakasi (Co Trikala)	021 14 502	39 46 060	1.303
32	Monodendri-Petrino Dasos, Zagoria (Co Ioannina)*	020 44 359	39 53 621	1.325
33	Marathos (Co Evrytania)*	021 37 205	39 05 011	1.368
34	Kritharia 1-Mikri Ondria (Co Kastoria)	021 05 824	40 20 512	1.421
35	Vrachiotika-Mikri Ondria (Co Kastoria)	021 05 786	40 20 482	1.438
36	Rema Agiou Pnevmatos, Gravia (Co Fthiotida)	022 18 772	38 47 163	1.480
37	Kritharia 2-Mikri Ondria (Co Kasroria)	021 05 543	40 20 260	1.485

Co – County

The formation of mixed stands in Ondria can be regarded as a surprising find, as the existing information has so far focused on isolated and scattered trees. The mixed stands were located on Mt Voio, in the north of the Pindos Range, at altitudes between 1000 m and 1600 m. Geologically, the area is described as reef limestone with Malacostrata (*Pecten, Ostrea*), Echinoders (*Clypeaster*), Algae (*Lithothamntum*), Bryozoa and Foraminifera (*Miogypsina, Amphistegina, Operculina,* etc.). The entire area is furrowed by small or large crevices and sounds of underground water can be heard from some of them. The crevices and numerous voids make the area quite inaccessible.

The sylvicultural form of the mixed stands rather resembles a dense, uneven aged forest of beech and horse chestnut, the latter exceeding 10% in the wood stock. Other species in these mixed stands were common alder [*Alnus glutinosa* (L.) Gaertn.], common ash (*Fraxinus excelsior* L.) and flowering ash (*F. ornus* L.), holly (*Ilex aquifolium* L.), etc. The age of the beech was estimated at about 120–130 years, while the age of the oldest horse chestnut was approximately 100 years.

Table 2 shows natural regeneration and the most frequently occurring diameter of trees: 25–50 cm. Protection and conservation of these southern populations of the species should be a primary concern.

As it can be seen in Table 1, a fair number of horse chestnut locations (18 out of 37) are included within the boundaries of *NATURA 2000* network of protected areas or national parks. A special report will go to the Greek Forest Service and the Ministry of Environment, which are responsible for managing all these protected areas and for enforcement of a conservation strategy on a national scale.

According to Heldreich (in Bergmaier 1990), horse chestnut is considered as one of the most beautiful trees of the indigenous European flora. It is a major amenity tree in all European cities, admired for its lush foliage and attractive flowers. In Greece, it grows best at altitudes above 250 m, but in recent years it has been planted in urban areas even along the coast. Unfortunately, in the last 15 years *C. ohridella* has been causing tremendous damage to the foliage of this amenity tree almost all over Europe (Butin & Führer 1994; Skuhravy 1999).

Table 2. Sylvicultural and dendrometric data describing the occurrence of *A. hippocastanum* in the different locations in Greece (n – number of trees; D – diameter).

Location no.	Location name	Seed lings	n<5	n 6-10	n 11-20	n>21	D>10 cm	D10-25 cm	D25-50 cm	D>50 cm	Details
1	Gavroneri, Stomio (Co Larisa)	X		X				X			
2	Dragasia-Gravalo Pezouli-Megali Ondria (Co Kozani)	X				X				X	Mixed forest
3	Gefira Papakou, Karitsa (Co Larisa)	X	X					X			Cluster
4	Kalomoira, Paliochori (Co Trikala)		X						X		
5	Arkoudopouri, Melivia (Co Larisa)	X				X			X		Cluster
6	Kakoskali (Co Larisa)	X	X						X		
7	Geka, Melivia (Co Larisa)	X	X					X			
8	Kakoskali, Melivia (Co Larisa)	X	X						X		
9	Gomarolakas-Asfalto (Co Larisa)	X				X			X		Cluster
10	Vromoneri-Evrimenon (Co Larisa)		X					X			
11	Dasos Nanitsa (Co Trikala)	X			X				X		Cluster
12	Perivoli (Co Grevena)	X				X			X		Cluster
13	Katavothra-Evrimenon (Co Larisa)	X	X						X		
14	Pouri Artotinas, Lidoriki (Co Fokida)	X	X						X		
15	Kalliroi, Koukoufli (Co Trikala)	X	X						X		
16	Kranea-Milea (Co Grevena)	X	X					X			
17	Dasorema-Desi Kolovogianni (Co Fokida)	X			X				X		
18	Tzamia-Evrimenon (Co Larisa)	X				X			X		Cluster
19	Malakasi-Routzi (Co Trikala)		X				X				
20	Megali Loga, Lidoriki (Co Fokida)	X	X					X			
21	Gomarolakas-Evrimenon (Co Larisa)		X						X		
22	Rema Skorda-Evrimenon (Co Larisa)		X						X		
23	Vathirema (Co Trikala)	X			X				X		Cluster
24	Lake Plastira (Co Karditsa)		X						X		
25	Vaeni-Dasos Malamouli (Co Karditsa)	X				X			X		Cluster
26	Pano-Kalesmenou (Co Evrytania)	X	X							X	
27	Platanolaka-Kalesmenou (Co Evrytania)	X	X							X	
28	Mariolata Forest-Rocks (Co Fokida)	X	X					X			
29	Megalo rema, Nafpaktos (Co Aetoloakarnania)	X	X						X		
30	Mariolata Forest-Efkero Sakkouli (Co Fokida)	X			X						
31	Prionia Stangogianni, Malakasi (Co Trikala)	X			X					X	Cluster
32	Monodendri-Petrino Dasos, Zagoria (Co Ioannina)	X	X						X		
33	Marathos (Co Evrytania)	X	X							X	
34	Kritharia 1-Mikri Ondria (Co Kastoria)	X			X				X		Mixed forest
35	Vrachiotika-Mikri Ondria (Co Kastoria)	X				X			X		Mixed forest
36	Rema Agiou Pnevmatos, Gravia (Co Fthiotida)		X							X	
37	Kritharia 2-Mikri Ondria (Co Kastoria)	X			X					X	Mixed forest

Co – County

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