

Characterization of areas

I. Gymnospermae

Cupressaceae

Cupressus L.

1. *Cupressus sempervirens* L.

Tree growing up to 30 - 35 m, widely distributed and cultivated in nearly the whole Mediterranean region since ancient time. It is difficult therefore to determine precisely its natural area. Two essential forms can be distinguished in the species: f. *sempervirens* with raised twigs and narrow-conical crown, almost pole-like, and f. *horizontalis* (Mill.) Voss with a broader crown and branches outstretched or slightly ascending. These forms are sometimes considered to be varieties, even separate species. The former – f. *sempervirens* (= var. *fastigiata* Hansen, var. *pyramidalis* Nyman, var. *stricta* Aiton, *Cupressus pyramidalis* Targ.-Tozz.) thanks to its attractive crown shape has been widely used for decorative purposes, and is commonly grown in seaside areas, in park and cemeteries and is rare in the wild state. The other – f. *horizontalis* (= *Cupressus horizontalis* Mill.) is the form commonly occurring in natural condition in the east part of the Mediterranean, and in Iran.

It grows on Crete, between 300 - 1300 (1600) m a.s.l., and is an important component of the vegetation there. It is also known from the islands Karpathos, Samos, Kalimnos, Kos and Rodhos, and all over south Anatolia. It is found there at altitudes from 200 - 1200 m from Samsun Dagi in the west eastwards to the Amanus mountains and penetrating 40 - 50 km inland. Here and there *C. sempervirens* forms large or small stands on rocky, calcareous soils often with *Juniperus excelsa* Bieb., *Pinus brutia* Ten., *Abies cilicica* (Ant. et Kotschy) Carr., and *Cedrus libani* A. Richard, and also with *Quercus coccifera* L., *Arbutus andrachne* L., *Pistacia terebinthus* L., *Spartium junceum* L., *Myrtus communis* L., *Cotinus coggygria* Scop., *Phillyrea latifolia* L. etc. Some of the best preserved communities of cypress in Turkey are in the province of Antalya.

In north-west Syria *C. sempervirens* is known only from a few localities, being more common in Lebanon where it occasionally forms pure associations, or is accompanied by *Pinus brutia* Ten. It occurs there practically from sea level to 1000 m a.s.l. Further to the south *C. sempervirens* is found in Jordan where two populations are known far apart from each other and consisting of a few trees only. One of these localities is in north Jordan in the province of Gilead, and the other is in Edom south of the Dead Sea. In the latter locality, situated at an altitude of about 1500 m, only around 50 trees grow, each 200 - 400 years of age. They grow to a height of 10 m with a trunk up to 115 cm in diameter.

In Cyprus *C. sempervirens* is, besides *Pinus brutia* Ten., the most important tree in the north part of the island and forms pure and thick woods. It grows in different types of soil, though mostly they are calcareous.

In North Africa, *C. sempervirens* is found wild in Libya, in the mountains of north Cyrenaica. – Jebel el Akhdar, at about 700 m a.s.l. The only locality in Tunisia (Maktar) is probably not of natural origin,

while the cypress of Morocco, from the mountains of the Great Atlas (Haut-Atlas) belongs to another species — *Cupressus atlantica* Gaussen.

Apart from this compact, east-Mediterranean distribution *C. sempervirens* has some, undoubtedly natural, stations in Iran. In the north it is found situated near the Caspian Sea, in Mazandaran province (valley of Safid Rud and Rud-e-Chalus) and also in Gorgan. Near Pol-Zoghal, on a calcareous slope, about 500 m a.s.l. the cypress forms pure, loose woods.

C. sempervirens occurs also in south Iran, in three localities considerably removed from those of the north ones. These three localities are rudimentary ones and it may be that they are natural. The first lies in Fars province, south of Shiraz at about 1600 m a.s.l. where more or less 100 trees are found the largest being 12 m high with a trunk 5 m in circumference. The second stand is in Kerman province ca 5 km NW of Saidabad (Imamzadeh). In the third, in Baluchistan north of Khash (ca 1500 m a.s.l.), the trunk of the thickest tree is 12 m in circumference.

References: 17, 28, 57, 64 (1), 97, 123 (2), 127, 130, 151 (1), 197, 250.

Juniperus L.

Arborescent junipers of *Sabina* Endl. section are one of the most characteristic components of vegetation in dry and mountainous regions of South-West, Middle and Central Asia. From this territory a number of taxa have been described yet their taxonomic value is often doubtful. In different floristic publications or local Floras they are treated in quite contradictory ways. The nomenclature also causes a lot of confusion.

There is no critical analysis of this group throughout its distribution, and no studies of the variability of the various taxa (thickness of shoots, mono- and dioecious specimens, number of seeds in cones, maintenance of juvenile features in old specimens, colouring of needles, etc.). It is therefore rather difficult to work out the areas which, in spite of a lot of available information on localities, have to be taken (at least in some parts) as rather uncertain and in need of correction. Worthy of attention is the complex: *Juniperus excelsa* Bieb. — *J. polycarpus* C. Koch — *J. seravschanica* Komarov. Moreover hybrids between some species are found.

2. *Juniperus communis* L.

A circumboreal species, one of the most widely distributed and variable representatives of the genus *Juniperus* which includes a number of forms and varieties, growing either wild, or cultivated. There are great divergences of opinion in separating these and in their nomenclature and distribution.

At present *J. communis* is divided into 4 main subspecies, which differ both in growth form and in leaf width and length, as well as in their position of the twigs. These are: subsp. *communis* (Europe, south Siberia), subsp. *hemisphaerica* (J. et C. Presl.) Nym. (Circum-Mediterranean mountains), subsp. *nana* Syme (Arctic regions, mountains of Europe and Asia, western part of North America, southern Greenland) and subsp. *depressa* (Pursh.) Franco (Canada and United States).

In its typical subspecies *J. communis* grows as an erect shrub or small tree, 8 - 10 (12) m high. This subspecies is not known in south-west Asia, but has recently been found in European Turkey.

In Anatolia, in the Caucasus and in the mountains of east Afghanistan, north Pakistan and in the Himalayas subsp. *nana* is found. It is a low, dense and compact shrub, often prostrate. It grows mostly in high mountain areas, especially above the upper forest limit, where it is often the dominating shrub forming compact thickets. In Anatolia it is mainly distributed in the north part of the country, where it is found between 1100 - 2600 m a.s.l. At lower altitudes there are specimens with characteristics intermediate between subsp. *nana* and subs. *communis*, described as var. *intermedia* (Schur) Sanio. In Afghanistan subsp. *nana* occurs up to 3700 m, in Pakistan to 3900 m and in Kashmir even to 4200 m.

In addition subsp. *hemisphaerica* is reported from northeast Anatolia and north Iran. It is closely related to subsp. *nana*, but is more robust (shrubs to 2.5 m high) and has long prickly leaves. It is also found in mountain regions, 2000 - 2700 m a.s.l.

References: 64 (1), 76, 86, 103 (1), 177 (1), 197, 218 (1).

3. *Juniperus drupacea* Labill.

Syn.: *Areucethos drupacea* (Labill.) Ant. et Kotschy

Small tree, 12 - 15 (20) m high, with a pyramidal crown (when cultivated the crown can be columnar), narrower and denser in male specimens. An east-Mediterranean species, it is found in the Taurus and Amanus Mts. in south Anatolia, in the Jebel el Ansariye in north-west Syria and in the Lebanese mountains (south to Jebel es Sheikh = Mt. Hermon); also it grows in Greece on the Peloponnisos peninsula.

In south-west Asia *J. drupacea* grows mainly in coniferous forests: cedar — *Cedrus libani* A. Richard, fir — *Abies cilicica* (Ant. et Kotschy) Carr., pine — *Pinus brutia* Ten. and juniper-forests — *Juniperus excelsa* Bieb., or in scrub with such species as: *Quercus cerris* L., *Q. infectoria* Oliv. subsp. *boissieri* (Reut.) O. Schwarz, *Q. libani* Oliv., *Acer monspessulanum* L., *Ostrya carpinifolia* Scop., etc. It sometimes forms its own communities usually in a rather small area. It is found at altitudes between 600 - 2050 m a.s.l. but grows best from 1000 - 1500 m.

In Greece *J. drupacea* is only known from the mountain massif of Parnon Oros in the Arkadhia province, where it is found in two places only 35 km away from each other — Hagion Petros at the northern confines of the massif and Kosmas at the southern end (1100 m a.s.l.).

J. drupacea is often considered as a separate monotypic genus, *Areucethos* Ant. et Kotschy, because of its large cones (20 - 25 mm in diameter) and seeds united into a stone. The flesh of the cones is sweetish and utilized to make jams and beverages by people in Asia-Minor.

References: 64 (1), 75, 76, 163 (1).

4. *Juniperus excelsa* Bieb.

Syn.: *J. polycarpus* C. Koch, *J. excelsa* Bieb. subsp. *polycarpus* (C. Koch) Takht., *J. turcomanica* B. Fedtsch.(?)

Tree to 20 m high, occasionally larger e.g. in southwest Anatolia in the Taurus mountains, near Elmali where there is an aged specimen 25 m high and 680 cm in circumference.

The area of *J. excelsa* extends from the Balkans in the west to north-east and south-east Iran in the east. In Europe it grows in a few localities in Albania, Jugoslavia (Macedonia), Greece (Macedonia, Thraki and Euboea), south Bulgaria and in the Crimea. In Anatolia, however, where juniper forests comprise 3.5% off all forested land, it is, apart from *J. oxycedrus* L., the most common representative of the genus *Juniperus*. Elsewhere in south-west Asia it is found on Cyprus, in Lebanon and the western regions of Syria adjacent to it, in west Iraq (very rare), and also in Iran. It also grows in the Caucasus, south Turkmenskaya SSR (?) and in the Arabian peninsula — Jabal al Akhdar in Muscat.

In dry and mountainous regions of Anatolia and Iran, and especially within the Irano-Turanian floristic area, *J. excelsa* plays an important role forming not only its own communities (*Juniperetum excelsae*), or those with other juniper species (e.g. *J. foetidissima* Willd.), but also delimiting the timber line.

In south Anatolia and in Lebanon *J. excelsa* grows in cedar-, fir-, and pine-forests and, together with oaks, in different steppe-forest communities, mostly as shrubs. In associations of Mediterranean vegetation (maquis) it is lacking or very rare. It spreads easily in deforested places.

It is resistant to dry weather, and warmth. It grows mainly on stony or rocky, sunny slopes from 300 m a.s.l. up to 1000 m in the Crimea, to 1720 m in Lebanon, 2.500 m in the Caucasus, 3000 m in Turkey, and even to 3400 m in Iran (Shah Kuh in Prov. Kerman).

The taxonomy of this juniper is not very clear. In this work *J. polycarpus* C. Koch. and *J. turcomanica* B. Fedtsch. have been taken as synonyms of *J. excelsa*, as the differences in these three species are not considered distinct enough to treat them as separate taxa. *J. polycarpus* is most often recorded from the Caucasus and Iran, and *J. turcomanica* from the mountains of south Turkmeniya.

References: 64 (1), 71, 76, 77, 103 (1), 104 (1), 151 (1), 163 (1), 218 (1), 228 (2).

5. *Juniperus foetidissima* Willd.

Tree 12 - 16 (20) m high, trunk 40 - 60 cm in diameter, often growing as a shrub.

The area of this species overlaps with that of *Juniperus excelsa* Bieb. although it is not found in Iraq or Syria; in Lebanon and in Iran it is very rare, known only from a few localities. On the Balkan peninsula it often grows in Albania and Greece where it covers the Peloponnisos but it is not found in Bulgaria.

Compared with other arborescent junipers of south-west Asia, chiefly *J. excelsa* Bieb., it is less resistant to dry weather and heat and requires less light. It is found in undergrowth of forests composed of mesophyllic species. Thus it, too, grows mainly in open places, in dry, gravel-clayey soils, often with other junipers.

In Anatolia which can be taken to be the centre of distribution of *J. foetidissima* it occurs from 600 - 2000 m a.s.l., on Cyprus between 1500 - 1950 m and in the Caucasus to 1600 m. The lowest localities are at sea level near Novorossiysk at the Black Sea (USSR).

This species is sometimes included in *J. excelsa*, opinions differ about some localities.

References: 64 (1), 76, 77, 104 (1), 151 (1), 163 (1), 218 (1).

6. *Juniperus oxycedrus* L.

Syn.: *J. rufescens* Link

A shrub or a small tree of 5 - 10 m, to 1 m in circumference. In extreme cases, for instance in east Transcaucasus (Azerbaijan), it is a very big tree, the thickest specimen, found so far, being 270 cm in circumference at a height of 50 cm above the ground.

A circum-Mediterranean species, it extends north to a latitude of 45° (France, Italy, Yugoslavia). In addition to Europe and north-west Africa it is found in the Caucasus and south-west Asia - Anatolia, Cyprus, west Syria, Lebanon, north Israel, north Iraq, and north-west Iran (here rather seldom). In Anatolia it is represented by two subspecies: the typical subspecies - subsp. *oxycedrus* which covers almost the whole country and is only lacking in very dry inland regions, and subsp. *macrocarpa* (Sibth. et Sm.) Ball which is only known from the shores of the Aegean Sea. The latter taxon is sometimes regarded as a separate species - *J. macrocarpa* Sibth. et Sm. and its area includes the real coastal regions of south Europe - maritime sands or rocky places.

J. oxycedrus has no particular habitat requirements and grows in nearly all forest, thicket and steppe-forest communities, but also in very sunny places. In forests (above all in pine, cedar and oak forests) it grows singly or in small or large groups in the undergrowth. Where forests have been devastated it spreads easily and here and there forms secondary associations - *Juniperetum oxycedri*. In open and dry places, in stony areas or on rocks it mostly grows as a dwarf shrub.

J. oxycedrus ranges in altitude from the sea-shore to high mountain areas, but it grows best between 500 - 1200 m a.s.l. In Anatolia its highest localities are 2000 m (Adiyaman: Momoski tepesi), in Iraq - 1750 m, on Cyprus - about 1600 m, and in the Caucasus - about 1000 m.

The most common species of juniper in Turkey but because of its slow growth and small size it has rather little economic value.

References: 64 (1), 76, 87, 103 (1), 104 (1), 151 (1), 163 (1), 218 (1), 228 (2).

7. *Juniperus phoenicea* L.

Small tree, 4 - 8 m tall; on seaside dunes it grows in a procumbent form. An Omni-Mediterranean species, but represented much more profusely in the western than in the eastern part of this region. It occurs throughout almost all the south of Europe, from south Portugal to Greece, as well as on the Canary Islands, on Madeira, and on the Islands of the Mediterranean (Balearic Islands, Corse, Sardegna, Sicilia, Crete, Aegaeon Islands, Rodhos). In north-west Africa, in Algeria and Morocco it is a common species, appearing from sea level to 2400 m in the Atlas Mts. It is also mentioned from Tunisia and Libya (Tripolitania, Cyrenaica).

In south-west Asia the area of *J. phoenicea* is limited to a few localities, often greatly isolated from the main centre of distribution. In Turkey it grows only in south-west Anatolia, in littoral habitats up to 400 m. On Cyprus *J. phoenicea* is one of the common species in lowland scrub-forests, often forming dense thickets, but it does not grow over 700 m.

In south-west Jordan, south of the Dead Sea between Wadi Dana and the village of Um Suwwana, 600 - 1500 m, *J. phoenicea* open forests stretch over an area of about 150.000 ha in the form of a narrow strip, on thin and eroded sandy loams. They are pure juniper woods or mixed slightly (10 - 30 percent) with such species as *Quercus coccifera* L., *Pistacia palaestina* Boiss., *Crataegus aronia* (L.) Bosc., *Daphne linearifolia* Hart and *Rhamnus dispermus* Ehrenb.

Similar area the communities of *J. phoenicea* in the north of the Sinai peninsula (Gebel El-Maghara, Gebel Halal and Gebel Yellag). The juniper is found here between 400 - 1000 m in very dry habitats, on a bare, calcareous, rocky substratum, where the annual rainfall is hardly 80 - 100 mm. Individual trees reach 2 - 4 m high, and the oldest are about 500 - 535 years old.

It is possible that *J. phoenicea* grows still farther to the south, in the western part of the Arabian peninsula (Jebel Radhwa in the Hejaz, and south of Mecca - El Hoda near Taif). It has not been confirmed yet whether the information that exists about the genus from this region refers just to this species.

References: 10, 29, 76, 112, 127, 132, 151 (1), 234, 241.

8. *Juniperus sabina* L.

A prostrate or ascending shrub, usually not more than 1 m tall. A Eurasian species with a very extensive overall distribution but, within this, limited to certain areas. It is met in the mountains of South and parts of Central Europe, and also in the Crimea, between 1000 - 3000 m. Exceptionally it grows at lower altitudes, as in the Pieniny Mts. in Poland, and in the south-west European part of the USSR (the middle Don, south Ural Mts.). One isolated locality for this species is in north-west Africa, in the Djurdjura Mts. (Kabyliya) of Algeria. In the Caucasus it is widely spread, especially in the Great Caucasus range, between 1500 - 3000 m.

In Asia, just as in Europe the species occurs in separate regions. *J. sabina* appears in the steppe zone of north Kazakhstan (Tarbagatay, Dzhungarskiy Ala-Tau, Tyan-Shan Mts.), in the mountains of north and east Kirgiziya, in south Siberia (West Sajon and Altai Mts.), in the mountains of north Mongolia and in north-west China (Dzhungaria, Kashgaria, Nan-Shan Mts.) where it reaches a height of 3300 (3700) m.

In south-west Asia *J. sabina* grows only in Turkey and Iran, and only in a few localities. In Turkey most of the localities are found in the north, especially north-east Anatolia, while the sole station in the south part of the country is on Ahir Dagħ, in the province of Maraş. The latter is the highest locality of this juniper in Turkey - about 2000 m the other ones being situated between 1300 - 1800 m. *J. sabina* grows much higher in Iran, where it is known only in the north part of the country, from the central Elburz Mts., in the province of Mazandaran and Gorgan, 2160 - 3300 m.

In this part of Asia *J. sabina* behaves like a subalpine species and grows in open, sunny and dry places, especially on calcareous rocks. Above the upper forest limit it sometimes forms extensive and compact carpets, pure or mixed with *J. communis* L. subsp. *hemisphaerica* (J. et C. Presl.) Nym.

References: 64 (1), 76, 77, 95, 104 (1), 149, 197, 218 (1).

9. *Juniperus semiglobosa* Regel

Syn.: *J. jarkendensis* Komarov, *J. schunganica* Komarov, *J. talassica* Lipsky

• A tree up to 10 - 15 m high, frequently with several stems reaching 60 - 80 cm in diameter, and in exceptional cases ever to a 1.5 m.

This is a central Asiatic species. Compared with *J. seravschanica* Komarov it is characterized by a much smaller range restricted to the mountain massifs of central Tyan-Shan and Pamir-Alai (Tadzhikistan, Kirgiziya, Uzbekistan and the most southeastern part of Kazakhstan), northeastern Afghanistan, northern Pakistan and Kashmir. It is also reported from China, from western Kashgaria. While the western and northern limits of its distribution are well known those to the south and east still require further study.

J. semiglobosa grows in higher altitudes usually above 2000 m on various soils differing both in physical and chemical composition, on bare rocks and on stony slopes. Frequently, on more dry sites, it occurs together with other woody junipers (*J. seravschanica* Komarov, *J. turkestanica* Komarov), more rarely it forms pure communities and these at elevations from 2300 to 3000 m. In more moist conditions it is accompanied by such species as *Betula*, *Sorbus* and *Populus*.

In western Pamir *J. semiglobosa* attains an altitude of 3860 m, in Afghanistan (Badakhshan, Wakhan) 3800 m and in Kashgaria 3600 m. It forms hybrids with *J. seravschanica* Komarov, *J. turkestanica* Komarov, *J. pseudosabina* Fisch. et Mey. and *J. sabina* L.

References: 95, 97, 122, 137, 149, 177 (1), 197, 218 (1).

10. *Juniperus seravschanica* Komarov.

Syn.: *J. polycarpus* C. Koch var *seravschanica* (Komarov) Kitamura

This is a tree 15 - 18 (20) m tall with a dense, dark green, conical, low set crown, the trunk attaining about 2 m in circumference and usually somewhat irregular in cross section. Sometimes, however, its dimensions may be much greater. For example in the mountains of Middle Asia in the USSR specimens are known with a trunk diameter of 2.2 m and in India (Lahoul) even up to about 3.5 m.

The range of *J. seravschanica* is very difficult to define particularly since the systematic position of the species is not yet sufficiently clearly defined. On the one hand it is considered to be an independent taxon, whereas on the other it is included in *J. excelsa* Bieb., *J. polycarpus* C. Koch or *J. macropoda* Boiss., the latter two themselves frequently being considered synonymous with *J. excelsa* Bieb. Until this question is resolved the range of *J. seravschanica* can be only very generally circumscribed. It represents an eastern vicariad of *J. excelsa* Bieb., the common stands being found in northwestern Afghanistan (province Herat) and in Baluchistan (?)*

This is a long-lived plant, growing very slowly (1 - 2 cm in height annually), distinctly resistant to drought and heat and it is heliophilous. In the north of its range it is widely distributed in the mountains of Tadzhikistan, Uzbekistan, southern Kirgiziya and southern Kazakhstan where it attains its northern limit in the Chu-Iliyske Mts. Here *J. seravschanica* grows on stony and rocky slopes, usually at an altitude between 1000 and 2500 m, forming frequently pure though sparse communities, particularly in the upper reaches of the mountains. The upper limit is reached at 2800 (3000) m where only single specimens grow. In places it is accompanied by *J. semiglobosa* Regel with which it forms hybrids. These are also known with *J. sabina* L. and with *J. turkestanica* Komarov.

In similar conditions it can be found in northern and eastern Afghanistan, in Pakistan, in Kashmir and in northwestern India, usually at altitudes above (1500) 2000 m. The further it reaches eastwards the higher altitude it attains, 3600 - 4000 m in the Hindukush and in Kashmir even 4250 m. Pure stands covering considerable areas can be found in southeastern Afghanistan and in Baluchistan (east of Quetta). It is not clear where in the east the range of *J. seravschanica* terminates but it probably does not reach Nepal.

* O. Kerfoot, Johannesburg (1980 in litt.) who is working on the genus *Juniperus* believes that *J. seravschanica* is synonymous with *J. excelsa*.

In Middle and Central Asia *J. seravschanica* is a valuable forest species. Its wood is a valuable building material, it is used as firewood and in the manufacture of pencils, while charcoal and incense are also obtained from it.

References: 30, 95, 97, 137, 171, 177 (1), 179, 186, 197, 214, 218 (1).

Pinaceae

Abies Miller

11. *Abies cilicica* (Ant. et Kotschy) Carr.

Tree 30 - 35 m high, the trunk with a circumference up to 2 m. The area of *A. cilicica*, both horizontally and vertically, almost completely overlaps that of *Cedrus libani* A. Richard, covering south Anatolia - West and Central Taurus and the Amanus Mts. southwards to the mountains of Jebel el Ansariye, near Slenfe in north-west Syria and Ehden in north Lebanon, about 35 km south-east of Tripoli. The range is therefore slightly smaller than that of *Cedrus libani* A. Richard being unknown in the south-western Taurus and in central Lebanon.

In Turkey *A. cilicica* is found from 1200 - 2200 (2300) m a.s.l., mainly on south-west and western slopes exposed to rain bearing winds; it finds the best conditions on heights between 1600 - 1900 m. It forms pure (*Abietum cilicicum*) or mixed forests, mostly with *Cedrus libani* A. Richard, differing from the latter by requiring somewhat moister air and soil conditions and less light. In the fir forests of the Taurus besides the cedar - *Juniperus excelsa* Bieb., *J. oxycedrus* L., *Populus tremula* L., *Quercus libani* Oliv. and barberry shrubs are found.

In Syria, like *Cedrus libani* A. Richard, *A. cilicica* does not form pure stands, but is accompanied, to a great extent, by oaks, junipers, maples, and by *Ostrya carpinifolia* Scop., *Carpinus orientalis* Mill., *Sorbus torminalis* (L.) Crantz, *Fraxinus ornus* L., *Cerasus mahaleb* (L.) Miller etc. Here it grows on more humid north-west and western slopes, between 1200 - 1500 m a.s.l. In north Lebanon this fir is the dominating species in forest associations reaching 2000 m a.s.l.

A. cilicica is represented by two subspecies. One, the typical subspecies (subsp. *cilicica*), occurs in the larger eastern part of the area, and is characterized by hairy shoots when young, and by buds without resin. Subsp. *issaurica* Coode et Cullen has glabrous shoots when young, and resinous buds. It is found in the West Taurus, mainly in the provinces of Antalya, Isparta and Konya.

References: 11, 59, 96, 125, 146, 148, 150, 167, 235.

12. *Abies nordmanniana* (Stev.) Spach

Tree to 50 (60) m high, the trunk 1.5 - 2 m in diameter. Mesophyllic species, tolerating shade well. It grows in fertile, deep soils, both calcareous and acid. It forms pure stands, or in more or less mixed with spruce (*Picea orientalis* (L.) Link), beech (*Fagus orientalis* Lipsky) and even pine (*Pinus sylvestris* L., *P. nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe).

The area of *A. nordmanniana* can be clearly divided into three parts. The first covers the west Caucasus and north-east Anatolia (Dogu Karadeniz Daglari = East Pontus Mts.) and lies between 38°25' E in the west (between Giresun and Sebinkarahisar) and 44°35' E in the east. In the Caucasus fir forests are spread between 1200 - 2200 m a.s.l., although in some places on damper northern slopes they are found from 600 - 800 m a.s.l.; in Turkey their occurrence is limited to 1200 - 1900 m a.s.l. *A. nordmanniana* is represented in this

region, by the typical subspecies, subsp. *nordmanniana*, characterized by hairy shoots, and buds usually not resinous.

The second region lies in north-west Anatolia and runs from Ulu Dag (Olympus) in the west to the Kizil Irmak river valley in the east. Here another subspecies is found – subsp. *bornmuelleriana* (Mattf.) Coode et Cullen (= *Abies bornmuelleriana* Mattf.) – with glabrous shoots and usually resinous buds. This subspecies resists drought more than the former, and it ranges in altitude from somewhere between 300 m (not far from Zonguldak) to 2000 m a.s.l. (Ulu Dag).

The third region, the smallest, is situated in the Kaz Dagi mountains (Mt. Ida), in west Anatolia, near the Aegean Sea, between 1000 - 1700 m a. s. l. Here the fir grows on northern slopes in pure stands, or mixed with *Fagus orientalis* Lipsky. Though it is also ranked as a subspecies – subsp. *equi-trojani* (Aschers. et Sint.) Coode et Cullen – of *A. nordmanniana*, the taxonomic position of this taxon is not clear enough. It has also been considered as a separate species, endemic to Anatolia – *Abies equi-trojani* Aschers. et Sint., or even as a hybrid between the Greek fir *Abies cephalonica* Loud. and *A. nordmanniana* subsp. *bornmuelleriana*.

References: 59, 61, 62, 96, 103 (1), 104 (1), 125, 146, 148, 150, 213, 218 (1), 235, 247.

13. *Abies spectabilis* (D. Don.) Spach

Syn.: *A. webbiana* (Wall.) Lindl.

Tree to 60 m high, at higher altitudes small, stunted and gnarled. The area of this species stretches along mountain ranges from east Afghanistan (Nuristan) and north-west Pakistan, through Kashmir, Indian Himalayas, Nepal and Bhutan to Sikkim. In addition *A. spectabilis* is recorded from China (west Tibet). Its area is nearly the same as that of the closely related species – *Abies pindrow* Royle (= *A. webbiana* (Wall.) Lindl. var. *pindrow* (Royle) Brandis).

Opinions differ as to whether the two should be kept separate. Sometimes it is assumed that they are vicarious species. *A. pindrow* Royle with occurring at lower altitudes (1600 - 2100 - 2700 (3700) m a.s.l. and *A. spectabilis* at higher localities, between 2400 - 4270 m (mostly 2800 - 3800 m); sometimes both firs grow side by side. It may be supposed that literature records of *A. spectabilis* may, in some cases, refer to *A. pindrow* Royle and vice versa.

A. spectabilis is a mesophyllic species. It grows on northern and western slopes, in very humid air and soil conditions, in regions of high rain-fall, often above 2000 mm a year. It forms extensive upper montane coniferous forests, pure or mixed – lower down with *Picea smithiana* (Wall.) Boiss. and *Pinus griffithii* McClelland, higher with *Betula jacquemontii* Decne. (in the west) and *Betula utilis* D. Don (in the east). They all reach the snow-line. In the east part of the area, together with *A. spectabilis* *Tsuga dumosa* (D. Don) Eichl. is found, along with evergreen species of oaks and different species of rhododendrons, and, in Tibet – *Picea likiangensis* (Franch) Pritz.

Where it occurs *A. spectabilis* is an important timber and is also used to produce matches and paper pulp.

References: 30, 96, 146, 148, 171, 173, 179, 186, 196, 214.

Cedrus Link

14. *Cedrus deodara* (D. Don) G. Don

A long-lived, huge tree to 50 m high, sometimes to 75 m, and over 13 m in girth. When young it forms a pyramidal crown, when old the top is flat and spreading.

The species is widely distributed in the Himalayas in an area from east Afghanistan in the west to Garhwal

in the east; it occurs also in Nepal in isolated localities. It grows in mountains from 1200 - 3300 m a.s.l., usually between 1500 - 3000 m.

C. deodara is typically gregarious and is usually found in pure stands. It grows in regions where the yearly rain-fall is higher than 450 - 500 mm. In places with a dry climate the cedar forests are replaced by juniper (*Juniperus seravschanica* Komarov) but when the climate is humid *C. deodara* forms mixed forests with *Pinus griffithii* McClelland, *Picea smithiana* (Wall.) Boiss. and *Abies spectabilis* (D. Don) Spach, as well as with broad-leaved species of temperate forests.

In the west Himalayas *C. deodara* is one of the most useful tree species. It gives valuable, durable and good quality wood, widely used, especially for rail-sleepers, and in building and furniture manufacture.

References: 30, 85, 96, 171, 173, 179, 186, 196, 214.

15. *Cedrus libani* A. Richard

Magnificent, long-lived forest tree growing to 30 m or 40 m high with a trunk of 2 m in diameter. It has a cone-shaped crone when young, and an umbrella-shaped one when older. It grows in Turkey, Syria, Lebanon and on Cyprus.

A light requiring species, growing most often on calcareous soils, in rather humid regions with rain and snow, mainly from October till May. In winter the snow cover in cedar woods is as high as 1 m, and it can lie until May, especially in the higher regions.

In Turkey *C. libani* is spread mainly in the southern part of the country, in the west and middle Taurus, as well as in the Amanus Mts. It stretches from Fethiye (province of Muğla) and Acipayam (province of Denizli) in the west, to Ahir Dagħ (province of Maraş) in the east and is found from 1200 - 2200 m a.s.l. growing best in localities situated between 1500 - 1800 m. *C. libani* forms pure stands or mixed woody communities where in drier places it associates with *Juniperus excelsa* Bieb. and *J. foetidissima* Willd., and in damper ones with *Abies cilicica* (Ant. et Kotschy) Spach. The cedar of Lebanon is found in several areas, often remote from one another. Cedar woods were destroyed in historical times, and in their place communities of *Juniperus excelsa* Bieb. appeared. Nevertheless compact stands have been preserved as, for example, in the mountains south of Elmali in the western part of the province of Antalya.

Besides those of the Taurus and Amanus Mts. two isolated localities of *C. libani* are known from Turkey – one in central Anatolia in the Sultan Dağları mountains, north of Egridir lake (province of Afyon), and the other in north Anatolia, near Erbaa (province of Tokat). The latter is very interesting indeed: it is situated about 60 km south from the Black Sea, with a gap of about 300 km dividing it from the Taurus Mts. It consists of some small groups covering scarcely 120 ha. It is in this area that *C. libani* grows at its lowest altitude, between 600 - 1000 (1250) m a.s.l. On the whole cedar woods account for 3,5% of the forest cover in Turkey.

In north-west Syria *C. libani* is known only from the Jebel el Ansariye mountains (Djebel Alaouite) where it is found from 1000 m a.s.l. to the highest tops of the massif (ca. 1580 m). It does not form pure communities there, but is part of differing kinds of mixed forests, often degraded, together with oaks (*Quercus coccifera* L., *Q. infectoria*, Oliv., *Q. cerris* L.), maples (*Acer monspessulanum* L., *A. hyrcanum* Fisch. et C. A. Mey.) and junipers (*Juniperus drupacea* Labill. and *J. oxycedrus* L.).

Cedar woods in Lebanon grow in a very small area, at present hardly 300 ha, and are localized in the mountains of the north and central parts of the country. Further to the south traces of cedar woods are found at the south end of Jabal Barouk, more or less as high as Sidon. *C. libani* grows in the Lebanon mountains between 1400 - 1950 m a.s.l. In the north it grows with *Abies cilicica* (Ant. et Kotschy) Carr. while in the south, where this fir is not found, it grows in mixed woods with oaks and junipers.

In the past in Syria and Lebanon cedar woods covered much larger areas but were much destroyed in ancient times. Phoenicians used cedar wood to build ships, as well as exporting it to Egypt, where it was used in building temples and sarcophagi. Further devastation was done by Assyrians and Romans. In this century, during World War I, cedar woods were cut for fuel for the railway.

On Cyprus *C. libani* grows only in the north-west part of the island, in the centre of the Paphos Forest, between 900 - 1400 m a.s.l. It forms either pure woods, or accompanies *Quercus alnifolia* Poech, junipers, pine, *Alnus orientalis* Decne., *Acer syriacum* Boiss. et Gaill., *Crataegus aronia* (L.) Bosc. etc. Views on the taxonomic value of *C. libani* in Cyprus have not been unanimous so far. Sometimes it is treated as a separate species — *Cedrus brevifolia* (Hook. f.) Henry, or as a variety or subspecies of *C. libani* (subsp. *brevifolia* (Hook. f.) Meikle).

References: 11, 96, 113, 125, 151, 167, 227, 235.

Picea Dietr.

16. *Picea orientalis* (L.) Link

A magnificent, huge tree, 45 - 50 (65) m high with a trunk diameter of 2 m. Its range is limited to the eastern Colchic part of the Euxine province comprising the west Caucasus in USSR and north-east Anatolia. It overlaps the *Abies nordmanniana* (Stev.) Spach range to a high degree, though the fir occurs a little more to the north and much farther to the west, while the spruce grows farther to the east reaching the middle Caucasus; both species often grow together.

In Turkey pure or mixed forests of *P. orientalis* cover about 200 000 ha (ca 2 percent of Turkish forests). This species is mostly met here between 1000 - 2000 a (the most favourable conditions being between 1300 - 1800 m), but in places, e.g. in the Rize environs, it descends very low, down to 50 m, while in the Yalnizcam Mts. single specimens grow up to 2400 m (in the Caucasus to 2300 m). In Anatolia the area of *P. orientalis* stretches along a rather narrow belt on the north side of the main ridge of the Pontus Mts., from the very frontier of USSR in the north-east to the valley of the river Melet in the province of Ordu in the west (c. 37°47' E). Spruce forests form one of the most characteristic elements of vegetation in this part of Anatolia, and are represented by many variants in their composition, both with coniferous species — *Abies nordmanniana* (Stev.) Spach and *Pinus sylvestris* L., and with deciduous trees — *Fagus orientalis* Lipsky, *Quercus petraea* (Mattuschka) Liebl. subsp. *iberica* (Stev.) Krassiln., *Acer trauttvetteri* Med. etc. There is either no understorey in these forests or the floor is covered by evergreen species of shrubs such as *Laurocerasus officinalis* Roem., *Rhododendron ponticum* L. and *Ilex colchica* Pojark.

P. orientalis grows in different kinds of soils, thus showing no special needs. Its occurrence is mainly limited by climatic conditions, and, above all, by air humidity and the amount of annual rainfall (usually 900 - 1800 mm). With the air and soil getting drier (and drier) the spruce diminishes. Compared with *Abies nordmanniana* (Stev.) Spach it is, however, much more resistant to dryness. When young it enjoys shade. It grows slowly attaining 450 - 550 years of age.

References: 61, 103 (1), 104 (1), 125, 129, 213, 218 (1), 235.

17. *Picea smithiana* (Wall.) Boiss.

Syn.: *P. morinda* Link

A very large tree attaining a height of 60 m and girth of over 5 m. It has a characteristic pendulous habit with branchlets hanging like tassles.

A Himalayan species. The western limit of its area is in the Afghanistan province of Nuristan, the eastern in Kumaon. In Afghanistan it occurs between 1400 - 3500 m a.s.l. (usually above 2000 m) and in Pakistan, where it is fairly common, between 2200 - 3650 m. It grows gregariously, but does not form large areas of pure stands; it is commonly mixed with other conifers, mainly with *Abies spectabilis* (D. Don) Spach, *Cedrus deodara* (D. Don) G. Don and *Pinus griffithii* McClelland, and with some species of deciduous trees,

mostly with oaks (*Quercus floribunda* Wall. and *Q. semecarpifolia* Sm.). It grows in high rainfall areas – more than 600 mm.

The wood of this species, though not so precious as that of cedar, is widely used in the households of the local population in carpentry, for packing cases and boxes and for producing sulphide pulp for writing and printing paper.

References: 30, 171, 179, 186, 214.

Taxaceae

Taxus L.

18. *Taxus baccata* L.

A slow-growing extremely long-lived tree, 15 - 20 m high although exceptionally it can have much larger dimensions. In the Caucasus, in east Georgia specimens 32,5 m high and 160 cm in diameter have been found, while in Adzhariya – 2,5 m in diameter. In England, single old trees even have a trunk to 5 m in diameter.

The area of *T. baccata* covers nearly the whole of central and south Europe and parts of north, the Caucasus, Anatolia, north Iran and north-west Africa. It is, however, regressive not only because of the long-term destructive influence of man but also because of climatic changes (continentalism). In many countries it has become a very rare species, occurring only in a few localities as single specimens, and is preserved. In all likelihood it has never formed pure stands, though it could be a dominating tree here and there. At present large concentrations of yews are mainly known from the Caucasus (north-west Colchis, east Georgia, north Armeniya) and, in Europe, from Czechoslovakia (Velka Fatra), Hungary (Bakony Forest), the Ukraine (Kniazdów) and Poland (Wierzchlas).

In south-west Asia the yew is often found in Anatolia, but even here its localities are dispersed, frequent only in the north. It grows above 600 m a.s.l., its highest locality being in the Amanus mountains, above 2000 m. In Iran, at the Caspian Sea *T. baccata* grows between 800 - 1400 m, in the Caucasus to 2050 m, and in Africa to 2500 m a.s.l.

A very shade-loving species, needing dampish, fertile and calcareous soils. It mostly grows in undergrowth of beech forests or in mixtures of beech, fir and spruce. In Europe those consist of *Picea abies* (L.) Karsten, while in south-west Asia *Fagus orientalis* Lipsky, *Abies nordmanniana* (Stev.) Spach, *A. cilicica* (Ant. et Kotschy) Carr. and *Picea orientalis* (L.) Link are found.

References: 64 (1), 103 (1), 104 (1), 123 (2), 195, 218 (1).

II. *Angiospermae*

Aceraceae

Acer L.

19. *Acer campestre* L.

Small tree to 15 (20) m high, exceptionally higher. It grows best in riverside carrs, while in open and dry places it forms shrubs.

A. campestre grows over nearly all south and central Europe, north-west Africa (Algeria, Tunisia), the

Caucasus, north Anatolia and north Iran. In the north it penetrates to central Great Britain and south Sweden. It grows in different deciduous forests and in shrub thickets, both in shaded and sunny places, in plains, rising ground or in low mountains, mostly only to 1000 - 1400 m a.s.l. (in the Caucasus to 1800 m).

In Anatolia specimens are rarely found south of 40° N*. Altitudinally *A. campestre* is found from sea level at the Black Sea up to 2100 m a.s.l., though mostly between 300 - 1800 m. Both in north Anatolia and in the Caucasus it is considered to be the most common maple species, but in northern Iran it is rare, recorded mainly from the mountains of the provinces of Mazandaran and Gorgan from localities above 2000 m a.s.l. (up to 2600 m).

A. campestre is an exceptionally polymorphic species. It varies in leaf size and pubescence, depth of incisions between lobes and number of lobes, as well as in dentation of leaf margins, size and shape of samara, width of wings and indumentum of nutlets. Many varieties and forms have been distinguished, rarely correlated with the geographical distribution, and their classification is complex though two fundamental subspecies can be mentioned. One, subsp. *campestre*, has pubescent fruit and leaves more or less puberulent, the other, subsp. *leiocarpum* (Opiz) Pax has glabrous leaves and fruit. There are a number of intermediate forms between the two subspecies. Both subspecies occur in the whole region of the area of *A. campestre*, but differ in ecological requirements: *A. campestre* subsp. *campestre* grows in dry and sunny places, while subsp. *leiocarpum* grows mainly in forests, in shade, in damp and wet soils (e.g. in river valleys).

References: 64 (2), 103 (6), 165, 183, 199, 242 (2, 3), 246.

20. *Acer cappadocicum* Gled.

Tree reaching 20 - 25 m height, usually, however, much lower. It is distinguished by the twigs keeping their green colour for two years, often with a bloom.

The area of *A. cappadocicum* is divided into two distinct parts. Though there is no difficulty in drawing the border line of the western part the delimiting of the boundary in the east, beginning in north-east Afghanistan (Nuristan) and running eastward through Pakistan, Kashmir and the range of the Himalayas to Nepal and China, creates a number of problems unsolvable of present. This is caused, above all, by insufficient taxonomic analysis of maples in that part of Asia. *A. cappadocicum* is represented there not by its typical variety, but by other varieties, such as var. *indicum* (Pax.) Rehd., var. *sinicum* Rehd. et Wils. (= *A. cultratum* Wall.) and var. *tricaudatum* Rehd. et Wils. These varieties are sometimes treated as independent species, and their areas reach west and even central China. Together with such east Asiatic maples as *A. mono* Maxim., *A. truncatum* Bge. and *A. meyerii* Schwerin they form a closely related group of taxa whose separation is still problematic.

In south-west Asia *A. cappadocicum* is a typical representative of the Euxino-Hyrcanian flora. Its westernmost localities are found along the Black Sea, in north Anatolia, near Ordu, and in the USSR near Novorossiysk. Thence the species runs eastwards along the range of the Great Caucasus to the shores of the Caspian Sea. Through the Talish Mts. and the provinces of northern Iran (Gilan, Mazandaran, Gorgan) it reaches the western borders of the province of Khurasan. Some isolated localities are found in east Anatolia in the provinces of Erzurum and Muş.

A. cappadocicum is a mesophyllic species growing in damp places, often in river valleys, actually from sea level up to 1600 - 1700 m, and sometimes even to 2000 m.

It does not form pure stands but is a constituent to a greater or lesser extent of different types of mixed forest. Lower down these are mixed deciduous forests (*Alnus glutinosa* (L.) Gaertn. subsp. *barbata* (C. A. Mey.) Yaltirik, *Carpinus betulus* L., *Corylus avellana* L.) with oak and beech higher up — and also, in the Caucasus and Anatolia, fir and spruce forests. It tolerates shade well, and as a result, often plays an important role in the lower storey of forests and in undergrowth.

References: 30, 103 (6), 164, 165, 179, 183, 214, 244, 246.

* In 1981 H. Ern (Berlin-Dahlem) found this species in the Amanus mountains, S. Anatolia.

21. *Acer divergens* Pax

Syn.: *A. quinquelobum* C. Koch

This is a shrub or a small tree, reaching 5 - 6 m in height. It grows on exposed, sunny and dry, stony mountain slopes and also in rock fissures. It occurs in thickets of oak, junipers, *Cotinus coggygria* Scop. and *Rhamnus pallasii* Fisch. et Mey., between 400 and 1500 m. It is characterized by leathery, small leaves, 1.5 to 4 cm long and 1.7 to 5 cm wide. Besides the typical variety with 5 lobes (var. *divergens*) there is also a variety with 3 lobes (var. *trilobum* Yaltirik).

This is an endemic species of maple for Turkey, reported only from the northeastern part of the country, from the provinces of Artvin and Erzurum.

References: 103 (6), 183, 246.

22. *Acer hyrcanum* Fisch. et C. A. Mey.

Small tree 12 - 15 (20) m high, 30 cm in diameter. A drought-resistant species requiring light and warmth. It is found in the Balkans (Jugoslavia, Bulgaria, Albania, Greece, Turkey), in the Caucasus, in Anatolia, north-west Syria (rare), in north and central Lebanon and in north Iran. In the north-west it reaches the Velebit mountains in Croatia (Jugoslavia).

In Bulgaria, where its northern limit runs along the massif of Stara Planina, it grows in different kinds of thicket, and in light deciduous and coniferous forests (*Abies alba* Mill., *Picea abies* (L.) Karsten, often on rocky, mainly calcareous substratum, between (400) 800 - 1600 m a.s.l. Sometimes, as, for instance, in the Rodopi Planina, it forms small distinct groves.

The situation is similar in Anatolia though in the mountains of the eastern part of the country, it can be found as high as 2300 m a.s.l. In south Anatolia it is found singly in oak forests (*Quercus cerris* L., *Q. libani* Oliv.) and in open cedar (*Cedrus libani* A. Richard) and fir forests (*Abies cilicica* (Ant. et Kotschy) Carr.). It also occurs in such communities in the mountains of Syria and Lebanon, between 1300 - 1750 m a.s.l. In the Caucasus it is frequently found in the south, in the Talish and Karabakh mountains (Azerbaijan) while in Iran it is rare, only known from a few localities in the Elburz Mts. in the provinces of Gilan, Mazandaran and Gorgan, above 1800 m a.s.l. (to 2400 m).

The variability of *A. hyrcanum* requires further study and so opinions as to the classification of its forms vary much among taxonomists. It is assumed that in its typical form *A. hyrcanum* (subsp. *hyrcanum*) occurs only in the Caucasus, in Iran and north Turkey. Forms from the Balkans are sometimes treated as a separate species — *Acer intermedium* Pančić. It is most variable in south Anatolia. Here in the western Taurus two subspecies have been distinguished: subsp. *keckianum* (Pax) Yaltirik, and subsp. *sphaerocaryum* Yaltirik, while subsp. *tauricolum* (Boiss. et Bal.) Yaltirik is supposed to grow in central Taurus and in Syria and Lebanon. It is sometimes treated as an independent species — *Acer tauricolum* Boiss. et Bal.

References: 91, 103 (6), 163 (2), 165, 183, 199, 244, 246.

23. *Acer monspessulanum* L.

A small tree 10 - 12 m with a short trunk and a compact, round crown; frequently grows as a shrub, particularly in the eastern part of its range. It is characterized by the presence of numerous, thin, short shoots which look like thorns.

This is a polymorphic species, divided into several subspecies, although these are themselves sometimes treated as separate species. Subsp. *monspessulanum* is found in southern and parts of central Europe (France), in northwestern Africa and in southwestern Anatolia. The mountains of the central Taurus and the Amanus

Mts. in southern Anatolia are the home of subsp. *microphyllum* (Boiss.) Bornm. (= *A. hermoneum* Bornm. et Schwer.) which also grows in western Syria and Lebanon. In the Amanus Mts. subsp. *oksalianum* Yaltirik is also found; in the Caucasus, in northeastern Anatolia and in northwestern Iran – subsp. *ibericum* (Bieb.) Yaltirik; in northern Iran and in southern Turkmeniya – subsp. *turcomanicum* (Pojark) Rech. f.; in south-eastern Anatolia, in Iraq and in Iranian Kurdistan – subsp. *assyriacum* (Pojark.) Rech. f.; in southwestern Iran – subsp. *cinerascens* (Boiss.) Yaltirik and in southern Iran – subsp. *persicum* (Pojark.) Rech. f. It appears that the latter two subspecies could easily be treated as one separate species characterized by two forms, in one the leaves and interior of the fruit locules are pubescent (subsp. *cinerascens*) and in the other glabrous (subsp. *persicum*). These are clearly the most xeromorphic taxa of the whole genus and in southwestern Asia they grow in extremely dry regions, reaching, in southern Iran, almost 27° N in the vicinity of Bandar-Abbas on the Persian Gulf (Kuhha-ye Genu Mt.).

A. monspessulanum is a light demanding species, especially towards the southeast of its range. It usually grows on exposed sunny slopes in communities of xeromorphic shrubs and in open forests such as the fragmentary sparse forests of *Cedrus*, *Juniperus* or *Quercus* (Anatolia, Syria, Lebanon), usually singly, more rarely in groups. Altitudinal distribution varies according to subspecies and geographic area but *A. monspessulanum* grows from 300 - 500 m reaching 1700 in the Taurus Mts. and up to 2600 m in the provinces of Bitlis and Hakkari (SE Anatolia). Usually, however, it is found between 900 and 1500 m.

In Iran subsp. *cinerascens* grows in the mountains between 1500 and 2800 m, subsp. *persicum* up to 3200 m and subsp. *turcomanicum* up to 2500 m. In the Caucasus subsp. *ibericum* has been reported from regions between 700 and 1800 m. The type subspecies – subsp. *monspessulanum* has its northern limit in southwestern Bulgaria, southwestern Romania and northern Yugoslavia. Here it usually occurs below 1200 - 1300 m only exceptionally going higher.

The closest relatives of *A. monspessulanum* are *A. sempervirens* L. and *A. syriacum* Boiss. et Gaill. and the three taxa are considered to constitute a separate series – *Monspessulana* Pojark.

References: 103 (6), 163 (2), 165, 182, 183, 199, 246.

24. *Acer pentapomicum* J. L. Stewart

Syn.: *A. regelii* Pax, *A. pubescens* Franch.

Small or medium-sized tree, with a thick crown, growing up to 10 - 15 (18) m, or a strong shrub. One of the most xerophytic maples in this part of Asia. It grows on dry, sunny and stony valley slopes, in communities of shrubs or low trees, usually singly though in the eastern part of the area it sometimes forms larger concentrations, or even pure thickets. It is locally common. It also appears in light juniper forests (in the west) and in evergreen oak forests (in the east). In altitude it extends from 800 to 2200 (2500) m.

In the western part of the area *A. pentapomicum* is often characterized by forms with smaller, dentate leaves and deeper incisions between the lobes. Such forms are often treated as a separate species – *Acer pubescens* Franch. As there are numerous intermediates it would seem more correct to consider *A. pubescens* as a subspecies of *A. pentapomicum*.

The area of *A. pentapomicum* thus understood stretches from south-east Uzbekistan, through Tadzhikistan, north-east Afghanistan, north Pakistan and Kashmir, to north-west India, probably up to the valley of the river Sutlej from where, however, there are no precise data making it impossible so far, to delimit the boundary in the east.

References: 30, 164, 165, 183.

25. *Acer platanoides* L.

Tree to 30 m high, with a trunk to 1 m in diameter. A Holarctic species, common in the whole of central and east Europe, and found also in Turkey, in the Caucasus, and in north Iran. In Europe its area spreads out from the Pyrenees in the west to the central Urals in the east, while the most northern localities are in

Scandinavia at about 63° N, and the most southern in Greece on the Peloponnisos thence to the Amanus mountains in south Anatolia, somewhere between 37 - 36° N.

A. platanoides does not form pure stands mostly growing singly in deciduous or mixed forests. Occasionally it is part of the main canopy, but it can be found very frequently in the low tree stratum and in the undergrowth. It is a lowland and submontane species growing between 200 - 1400 m a.s.l. and there attaining a considerable size. However, occasionally it can be found in mountains, and, for instance in Albania and in the Caucasus it can reach 1800 m a.s.l.

A. platanoides has its southern limit in south-west Asia. As a mesophyllic species it does not develop well there and its localities are very dispersed, mainly in north-west Anatolia near the Black Sea. Most localities are in mountainous regions seldom below 1000 m a.s.l. Its maximum altitude is in central Anatolia, on isolated, volcanic taluses of Erciyas Dagi and Namrut Dag – between 2200 - 2400 m a.s.l. At such heights *A. platanoides* grows mostly as a low tree of several metres.

The few localities of *A. platanoides* in north Iran are found in the provinces of Mazandaran, Gorgan and Khurasan (only north-west) where it has been found at 1750 - 2300 m a.s.l.

References: 103 (6), 165, 183, 199, 246.

26. *Acer semenovii* Regel et Herder

Shrub or small tree to 5 m high. This maple is closely related to the Euro-Asiatic *A. tataricum* L. and east Asiatic *A. ginnala* Maxim. and is sometimes considered as a subspecies or variety of one or other of these two taxa.

The area of *A. semenovii* is divided into two parts, remote from each other. The larger, richer part covers the middle-Asiatic republics of the USSR (Uzbekistan, Kirgiziya, and S. Kazakhstan) and the west end of Chinese Dzhungaria (valley of the river Kash and Tekes). Here *A. semenovii* is found more often in the west than in the east.

The north limit of the area runs along the mountain ranges of Karatau, Kirgizskiy and Zailiyskiy Alatau and Ketmen. It grows in river valleys and on stony or gravelly mountain slopes and ravines, in light forests and in thickets, together with species of *Crataegus*, *Rosa*, *Spiraea* and *Amygdalus*, from about 700 to 3000 m. Isolated from this main centre of the area, single localities can be found in the mountain ranges of Aktau and Nuratau, situated north of Samarkand, and in the south-west end of the Gissarskiy mountain range.

The second area lies in Afghanistan where *A. semenovii* is much rarer its area being limited, nearly exclusively, to the central range of mountains in the provinces of Herat, Bamian, Nuristan and Badakhshan, from 1500 - 2200 m. It grows mainly along gullies and river valleys, and sometimes on open slopes, where communities of arborescent junipers are met. In Badakhshan it grows with *Pistacia vera* L. and *Cercis griffithii* Boiss.

References: 165, 183.

27. *Acer sempervirens* L.

Syn.: *A. orientale* auct. non L., *A. creticum* auct. non L.

Small tree, 5 - 12 m, often only a shrub a few meters high, growing very slowly. Along with *A. syriacum* Boiss. et Gaill. it is another evergreen species of maple found in south-west Asia. It is distinguished by the extreme variability of the leaves, which may be undivided and then mostly ovate-elliptic or trilobed and wide-ovate in outline.

The area of *A. sempervirens* is limited almost exclusively to the Aegean Sea. In the west it is found mainly in south Greece (Peloponnisos), on Crete, and also on some islands (Sporades, Euboea, Cyclades), while

in the eastern part it appears occasionally on the shores of Anatolia and on the island of Chios. Its limits to the east is Antalya, and to the north the island of Samothraki.

A. sempervirens grows chiefly on rocky, calcareous soils in light pine (*Pinus brutia* Ten.), juniper (*Juniperus excelsa* Bieb.) or cypress (*Cupressus sempervirens* L.) forests, and in thickets of *Quercus coccifera* L. and *Phillyrea latifolia* L.; on the island Skirós it even forms small groves. It is most often met in areas situated not far from the sea, much more seldom inland. The lowest recorded localities of *A. sempervirens* are from Samothraki and Kithira – 100 m a.s.l., and the highest from Crete, Mt. Vokino – 1600 - 1700 m. In Anatolia it can be found between (100) 300 - 1350 (1600) m.

References: 64 (2), 188, 189, 246, 251.

28. *Acer stevenii* Pojark.

This is a tree 12 m tall. It occurs quite frequently in the mountains of southern Crimea, between 400 and 1300 m, particularly in the understorey of beech forests.

The species is closely related to *Acer hyrcanum* Fisch. et C. A. Mey. and sometimes is considered as only a variety of the latter. It differs, however, particularly in having leaves with longer and narrower lobes, a glaucous lower leaf surface and narrower fruit wings.

It is a Crimean endemic.

References: 182, 183, 242 (2, 3).

29. *Acer syriacum* Boiss. et Gaill.

Syn.: *A. obtusifolium* Sibth. et Sm.?

Evergreen, small tree to about 10 m high, or shrub. This is an eastern Mediterranean species, closely related to *Acer sempervirens* L. Its range is limited to Cyprus, Syria, Lebanon and northern Israel.

On Cyprus, where it is the only representative of the genus *Acer*, it occurs commonly in the mountain regions of the central and northern part of the island, at elevations between sea-level to 1340 m. Locally, it plays an important role in the composition of pine forests.

In Syria it is very rare species, known only from the vicinity of Latakia and from the southeastern frontier regions with Israel (near Baniyas).

It is widely distributed throughout western and southern Lebanon, as far north as the area around Tripoli. The southern limit of the range is reached in Israel, where it grows only in northern Galilee, at 32°59' N. near Pequi-in. In southern Lebanon and in Israel it is a component of the *Quercus coccifera*-*Pistacia palaestina* association growing between 300 and 900 m a.s.l.

References: 56, 113, 151 (1), 161, 163 (2), 244, 254, 259 (2).

30. *Acer tataricum* L.

Strong, upright shrub or small tree, to 10 m high, often with several trunks. The area of *A. tataricum* is limited to the south-east of Europe, the Caucasus and Turkey; it has also been reported from north Iran (East Elburz), but this information has not been confirmed, and it may be false or refer to a cultivated specimen.

In Europe *A. tataricum* occurs in south Czechoslovakia, west Austria, Hungary, Romania, Bulgaria and Albania, in a vast part of Jugoslavia, northernmost Greece and in Turkey, as well as in the southern

part of the USSR. Here it reaches 54° - 55° N and stretches eastwards nearly to the southern end of the Ural Mountains but it is unknown on the Crimean Peninsula. It is a steppe and forest-steppe species.

In Anatolia *A. tataricum* grows scattered in the north and east part of the country and is very sparse in the south (province of Antalya). Its localities are markedly isolated from those of Europe and the Caucasus. It is found in the undergrowth of light forests, or on their edges, as well as on open, sunny hills in shrub thickets, in gorges, and on river terraces. It usually grows individually but occasionally forms stands on the floodplains of larger rivers. It grows in mountains and on their foothills, between 500 - 1700 m.

A. tataricum withstands drought and low temperatures, and does not need good soil. It grows both in sunny places and in moderate shade. It is commonly planted in parks and forest plantations nearly all over Europe.

References: 64 (2), 103 (6), 183, 199, 246.

31. *Acer trauttveteri* Medv.

Medium sized tree, 15 - 20 (25) m tall, with a trunk 60 - 90 cm in diameter. It occurs in the Caucasus, north Anatolia and in European Turkey. A species closely related to *Acer pseudoplatanus* L. it may be that it should be treated only at subspecific level; its area forms an eastward extension of the latter taxon.

In the Caucasus, the main area of its distribution, *A. trauttveteri* is usually found in high mountains between 1800 - 2500 m a.s.l., although exceptionally it grows lower down to 1400 m. In upper localities it grows singly or in small groups in low and crooked birch and beech groves together with *Rhododendron caucasicum* Pall. and other alpine shrubs. Below this altitude it appears in coniferous forests (*Abies nordmanniana* (Stev.) Spach and *Picea orientalis* (L.) Link) and in beech forests (*Fagus orientalis* Lipsky).

A similar situation occurs in Anatolia where *A. trauttveteri* is found in mixed (*Abies-Fagus-Carpinus*) and deciduous forests (*Alnus glutinosa* (L.) Gaertn., *Carpinus betulus* L., *Quercus pedunculiflora* C. Koch, *Fraxinus oxycarpa* Willd., *Acer campestre* L., *Corylus avellana* L., *Cornus mas* L., *Laurocerasus officinalis* Roem, etc.). It does not grow as high up as in the Caucasus and occurs mostly between 700 - 2100 m a.s.l., and in some places even below 300 m; it grows lower down in the west of Anatolia than it does in the east.

A mesophyllic species needing fertile, wet soils containing calcium.

References: 64 (2), 103 (6), 183, 246.

32. *Acer turkestanicum* Pax.

A small tree, 12 - 15 m high with a trunk up to 35 cm in diameter. In optimum conditions it can even grow to 20 m with a trunk 80 cm in diameter.

A. turkestanicum is found mainly in Middle Asia (USSR) in the mountains of West Tyan-Shan and Pamir-Alai. There the northern limit is formed by the Chatkalskiy range, and the eastern by the Ferganskiy range in Kirgiziya, while the Baysuntau mountains and the west end of the Gissarskiy and Zeravshanskiy range in Uzbekistan form the western boundary. It also occurs, though rather seldom, in east Afghanistan (Nuristan province) and in north-west Pakistan (Chitral).

A. turkestanicum is one of the most mesophyllic maples of Middle Asia. It forms pure forests in humid places only, in valleys of mountain rivers and streams as, for instance, on the south-western slopes of the Ferganskiy range. It grows very often in walnut forests (*Juglans regia* L.) or on their edges. It is also found in spruce and fir forests (*Picea schrenkiana* F. et M., *Abies semenovii* Fedtsch.). Large concentrations of *A. turkestanicum* are found on the southern slopes of the Gissarskiy range, in the western part of Peter I range and on the Chatkalskiy range. In dry localities it forms open communities with other xerophytic shrubs, such as *Crataegus altaica* Lange, *C. turkestanica* Pojark., *C. songorica* C. Koch, *Caragana turkestanica* Komarov, *Calophaca grandifolia* Rgl., *Cerasus tianshanica* Pojark., *Malus siversii* (Ledeb.) Roem., etc.

As a rule it grows in groups due to its vegetative method of reproduction — the lower branches lie flat on the ground sometimes taking root, eventually replacing the parent tree on its death.

A. turkestanicum occurs in Middle Asia at altitudes from more or less 950 m a.s.l. to 2700 m, in Afghanistan it is found between 1900 - 2500 m and in Pakistan to 3000 m.

References: 164, 165, 183.

33. *Acer velutinum* Boiss.

A typical forest tree which can attain 40 m in height and 120 cm in diameter, although usually it is no more than 20 - 25 m tall. Its range consists of two basic parts. The first is much smaller and has fewer stands and covers the eastern tip of the Great Caucasus. The second area extends from the Talish Mts. and Lenkoran (southeastern Azerbaydzhan in the USSR) in the west along the southern shores of the Caspian Sea in northern Iran (northern slopes of the Elburz Mts.) to the Iranian province of Gorgan in the east.

A. velutinum is a characteristic relict species from the tertiary forests, referred to sometimes as the Hyrcanian forests. It grows on moist and rich soils, on mountain slopes and in gorges, together with *Fagus orientalis* Lipsky, *Carpinus betulus* L., *Tilia caucasica* Rupr., *Parrotia persica* C. A. Mey., *Gleditsia caspica* Desf., *Pterocarya fraxinifolia* (Poir.) Spach etc. It occurs either singly or in small groups. In the mountains of the southern part of Lenkoran it forms pure and dense though not very large forests. Altitudinally it extends from sea-level to 1800 m.

Throughout the region of its occurrence it is represented by two basic varieties, one with leaves softly pubescent on the lower side (var. *velutinum*) and the other with glabrous leaves (var. *glabrescens* Boiss. et Buhse). The species is closely related to *Acer caesium* Wall. which occurs in the mountains of the Hindukush and in the Himalayas.

References: 103 (6), 165, 183.

Betulaceae

Alnus Miller

34. *Alnus glutinosa* (L.) Gaertn.

A big tree to 25 - 30 (35) m high with a cylindrical crown. A Euroasiatic species, widely distributed over nearly all Europe, with the exception of north Scandinavia and the Peloponnisos in Greece. In the north it penetrates the arctic circle, in the east, in West Siberia, it reaches to the middle course of the river Ob, to the south it is found in the Atlas mountains in north-west Africa. It also grows in the Caucasus, in Anatolia and north Iran.

In south-west Asia *A. glutinosa* is represented by three subspecies: the typical subspecies — subsp. *glutinosa* occurs mainly in north-west and west Anatolia, — subsp. *barbata* (C. A. Mey.) Yaltirik in north-east Anatolia, in the southern Caucasus and in Iran, while subsp. *antitaurica* Yaltirik disjunct from the other two is found in south Anatolia, in the provinces of Maraş and Seyhan.

A. glutinosa is a typical mesophyllic forest tree, forming its own associations (*Alnetum glutinosae*) or mixing with other deciduous species. In Anatolia, especially in the western part, these species are: *Carpinus betulus* L., *Acer campestre* L., *Ulmus minor* Mill., *Platanus orientalis* L., *Fraxinus oxycarpa* Willd. and *Corylus avellana* L., while in the eastern part it also associates with *Ostrya carpinifolia* Scop., *Sorbus torminalis* (L.) Crantz, *Ulmus scabra* Hudson and *Diospyros lotus* L. Forests with this alder dominating are known

in the Caucasus and the shores of the Caspian Sea in Iran. In these Caspian forests *Alnus subcordata* C. A. Mey., *Acer velutinum* Boiss., *Diospyros lotus* L., *Fraxinus excelsior* L., *Ulmus glabra* Hudson, *Quercus castaneifolia* C. A. Mey. and *Tilia caucasica* Rupr., as well as numerous climbers grow alongside *A. glutinosa*.

A. glutinosa is a moderately light-loving tree, which will not tolerate upper shading, and therefore cannot exist under the crowns of other species. When young it grows fast. It gives offshoots from the trunk easily and this characteristic is utilized in forestry. It grows mainly in lowlands and low mountains, in fertile humid or even very wet soil, mostly in river valleys and streamsides. Altitudinally in Turkey it occurs right from sea-level to 1500 m a.s.l. (subsp. *glutinosa*), to 1600 m – subsp. *antitaurica*, while subsp. *barbata* is found up to 1700 m in Giresun and Trabzon provinces. Turkish alder forests cover hardly one percent of the countries total forest area.

The wood of *A. glutinosa* is rather soft and light, easily splintering, undurable in air but durable in water, suitable for civil engineering. It is used in carpentry and for wood turning. The bark is utilized in the tanning industry.

References: 36, 53, 66, 103 (3), 104 (2), 141, 244, 245.

35. *Alnus orientalis* Decne.

Tree 15 - 20 m high, which in favourable conditions (for example on Cyprus) can have a trunk circumference of 4 - 5 m at breast height. An East-Mediterranean species, endemic to south-west Asia.

Its area covers a rather narrow belt of Mediterranean coastland in south Anatolia – more or less from central Mugla in the west to the northern outskirts of the Amanus Mts. in the province of Seyhan in the east, thence to north Syria, west Lebanon and north-west Israel, where it grows as far south as Samaria. Strangely *A. orientalis* was mentioned from Upper Galilee, Carmel and Samaria (1,254) but was omitted in "Flora Palaestina" (259 (1)) and it may be that it has recently become extinct here. Occasionally it is found in upland localities, as on the south slopes of the Taurus Mts.

A. orientalis is found from sea level up to 1000 m a.s.l. and sometimes even higher, but mostly between 0 - 700 m. It grows mainly singly along rivers or in mountain stream gorges together with *Platanus orientalis* L., and also, in south-west Anatolia, with *Liquidambar orientalis* Miller. It does not form forests anywhere, although in Cyprus, Syria and in Lebanon it is rather common. This is quite a variable species, especially as regards pubescence of the shoots, leaf petioles and inflorescence axes. Because of this two varieties have been distinguished – var. *orientalis* and var. *pubescens* Dippel.

A. orientalis is closely related to *Alnus cordata* (Loisel) Loisel. found in Europe, on Corsica and in south Italy, and also to *A. subcordata* C. A. Mey which widespread in the forests along the south coast of the Caspian Sea in Iran and the USSR.

References: 1, 53, 113, 141, 161, 163 (1), 245, 254.

36. *Alnus subcordata* C. A. Mey.

A large tree which under optimal conditions, can reach 30 m in height with a trunk diameter of 160 cm.

This is typical representative of the forests of the Hyrcanian province, limited in its range to a narrow belt covering the southern shores of the Caspian Sea. It grows only in the Talish Mts., Lenkoran and in northern Iran, in lowland regions and in the lower reaches of the mountains, up to more or less 1000 m a.s.l. However, in Iran it occurs sporadically even higher, up to c. 1500 m.

A. subcordata generally occurs in wet localities, on banks of rivers and streams in conditions of high air humidity. On such sites it either forms pure stands, or grows with *Pterocarya farxinifolia* (Poir.) Spach (*Alneto-Pterocaryetum*) along with such other species as: *Alnus glutinosa* (L.) Gaertn. subsp. *barbata* (C. A. Mey.) Yaltirik, *Fraxinus excelsior* L., *Populus caspica* Bornm., *Salix excelsa* S. G. Gmelin, *Gleditsia caspica*

Desf., *Diospyros lotus* L. etc. At higher localities *A. subcordata* is a component of mixed forests, particularly of oak woods (*Quercus castaneifolia* C. A. Mey.). It is a pioneer species on deforested riverside terraces and on neglected or abandoned rice fields.

References: 36, 53, 103 (3), 104 (2).

Betula L.

37. *Betula jacquemontii* Spach

Tree to 15 m high or a shrub. A Himalayan species distributed in a narrow belt from Afghanistan (Nuristan and Kabul provinces), through north Pakistan (Chitral, Swat and Hazara provinces) and Kashmir up to north-west India (Kumaun). Farther to the east, in Nepal, Sikkim and Bhutan there is a closely related species — *Betula utilis* D. Don in which *B. jacquemontii* is included by some taxonomists. But then two taxa, it seems, differ quite distinctly in the number of pairs of veins on the leaves and in bark coloration. *B. jacquemontii* has a white or yellowish bark and leaves with 5 - 8 (9) pairs of veins, while *B. utilis* D. Don has a brownish or cherry-red tinge, (9) 10 - 14 pairs of veins and grows up to 25 m.

B. jacquemontii occurs in mountains, usually gregariously and is the species which delimits the upper tree line in this part of Asia. In Afghanistan it grows from 2300 - 2500 m to about 3400 m a. s. l., in Pakistan above 3000 m, and in northwest India even up to 4250 m. It is a very variable species, both in size of leaves, number of lateral pairs of nerves and in the size of the male catkins. All these features increasing in size from west to east.

The horizontally peeling bark of *B. jacquemontii* is used for roofing and as a substitute for writing paper, while the leaves are utilized as fodder for cattle.

References: 30, 36, 169, 179.

38. *Betula litwinowii* Doluch.

A tree to 15 m high, usually with an irregular crown and a crooked stem. It occurs in the USSR on the Caucasus and in eastern Anatolia, between 1500 - 2800 m. Occasionally in northwestern Caucasus and in western Georgia it occurs also at lower altitudes.

In the USSR *B. litwinowii* is the most common species of birch in the range of the Great and Lesser Caucasus, where the climatic conditions are continental. In the southern Caucasus it is rather rare and it is completely absent from the Talish Mts. (southeastern Azerbaydzhan) and in the Nakhichevan Autonomous Soviet Republic. In Anatolia the range of the species is more restricted than that of *Betula pendula* Roth. and covers only the provinces of Erzincan, Tunceli and Kars.

In the upper altitudes of the Caucasus Mts. *B. litwinowii* forms, together with *B. pendula* Roth, a zone of birch forest. Besides birch such species of trees as *Sorbus aucuparia* L., *Acer trautvetteri* Medv., *Salix caprea* L., and even *Fagus orientalis* Lipsky and *Quercus macranthera* Fisch. et C. A. Mey. also occur. It is found too as a component of subalpine pine, spruce and fir forests.

It is rather a variable species, represented by several local varieties and sometimes mistaken for the European *Betula pubescens* Ehrh., which, however, is unknown from the region.

References: 42, 103 (3), 104 (2), 218 (1), 232.

39. *Betula medwedewii* Regel

Syn.: *B. megrelica* D. Sosn.

This can be either a small tree or a tall shrub. It is characterized by a peculiar form of growth, the lower portion of the trunk, to about half its length or even more being prostrate, and frequently rooting thereby establishing new individuals. The length of the prostrate stems can be as much as 13 - 15 m, while the terminal part rises to about 5 - 6 m. In this way, by means of vegetative propagation, individual trees gradually develop into whole thickets.

The range of *B. medwedewii* is restricted to a limited area covering the southwestern part of Transcaucasus in the USSR (Guria, Adsharia, and Megrelia Mts.) and the Lazistan Mts. in the north-eastern Black Sea areas of Turkey. It occurs primarily in the subalpine zone of low and gnarled forests, particularly between 1500 and 2300 m. It occurs also lower down, from 800 m, on the slopes of moist gorges and valleys, among thickets of evergreen shrubs. In the upper parts it either forms pure or mixed low forests or thickets together with such species as *Quercus pontica* C. Koch, *Sorbus subfusca* (Ldb.) Boiss., *Rhododendron ponticum* L., *Rh. caucasicum* Pall., *Laurocerasus officinalis* Roem., *Vaccinium arctostaphylos* L. etc. The greater the altitude the lower the thickets and at the upper limit of its distribution *B. medwedewii* attains scarcely 2 m in height. It grows on moist and damp shallow skeletal soils.

In Turkey it is the only representative of the section *Costatae* (Rgl.) Koehne. Other species of this section occur on the Caucasus (*Betula raddeana* Trautv.), in eastern Afghanistan (*Betula jacquemontii* Spach) and particularly in East Asia and North America.

References: 42, 103 (3), 104 (2), 218 (1), 232.

40. *Betula pendula* Roth.

Syn.: *B. verrucosa* Ehrh.

Three growing up to 25 - 30 m, with a broad loose crown and drooping young shoots. A Euro-Asiatic species covering an enormous area, including nearly the whole Europe (with the exception of the Iberian peninsula, Sardinia, Peloponnisos, and the most northern regions of Scandinavia and USSR) as well as western Siberia and the Caucasus, east and central Anatolia, though here only in a few localities, northern Iran and northern Iraq. In the north it reaches 69° N in Norway, while stretching east to the basin of the river Yenisey, to 100 - 105° E.

In the central and northern part of its area, *B. pendula* is an important component of woods and occurs almost everywhere, especially on low ground. It behaves differently in south-west Asia where it has the south limits of its distribution. Though this birch has few soil and light requirements and is resistant to low temperatures, it is less resistant to the dry climate of this region, and therefore it grows exclusively in mountains, usually above 1800 m, and even up to 3000 m (Nemrut Dag near Bitlis on Lake Van). At such heights *B. pendula* does not grow as high as in Europe or Siberia, but forms small scattered woods or groups seldom reaching a height of more than ten meters.

In Anatolia the localities of *B. pendula* are widely dispersed, though most of them are situated in the north-east of the country the only isolated locality in the central area being in the highlands of Erciyas Dagi in the province of Kayseri. In Iran this birch is very rare, and its few localities are located in the central part of the Elburz, in the province of Mazandaran (above 2000 m a.s.l.). Recently it has also been discovered in the province of Azerbaydzhan, in the mountains at the north end of Lake Rezaiyeh (2200 m). In Iraq only one locality is known situated at its border with Turkey (1840 m).

Because of its scattered comparatively high stands and the small size which it attains *B. pendula* is not of great importance to forestry in south-west Asia.

References: 36, 42, 103 (3), 104 (2), 141, 218 (1), 232.

Corylaceae

Carpinus L.

41. *Carpinus betulus* L.

Syn.: *C. caucasica* Grossh.

Tree to 20 - 25 m high with fluted trunk and smooth gray bark. In the Caucasus it can even reach 35 m.

The area of *C. betulus* covers the whole of central and south-east Europe, the Caucasus, north Anatolia and north Iran (provinces of Gilan, Mazandaran and Gorgan). In the north it penetrates to south Sweden to more or less 57° N. It is not found on the Iberian Peninsula, Corsica, Sardinia, Sicily and the Peloponnisos nor on the shores of the Mediterranean Sea.

In south-west Asia *C. betulus* is limited to the Euxine and Hyrcanian Provinces. Though in the main it is a lowland and submontane species here it grows in high mountains reaching 1600 m in Anatolia, 2000 m in the Caucasus, and 2300 m in Iran in the Elburz Mts.

C. betulus is a mesophyllic forest tree with varying ecologic requirements. Though the best conditions are in rich, deep and wet soils, it also grows quite well in dry, shallow skeletal soils. It tolerates shade well, especially in a rich habitat, and in this respect it is, with the beech, the most shade-tolerant deciduous tree. It can therefore occur in the second storey, under the crowns of other trees, both deciduous and coniferous (fir, spruce). On the other hand it grows abundantly in sunny places, in open spaces after cutting down forests. Usually *C. betulus* is found as a constituent of various deciduous forests, mainly beech, oak and chestnut. In dry places it sometimes grows with *Carpinus orientalis* Miller.

In Turkey hornbeams (*C. betulus* and *C. orientalis* Miller) cover about 2,7 percent of the total forest area. In Iran, in the Caspian forest, *C. betulus* is a very frequent associate of the *Fagetum orientalis* and *Quercetum castaneifoliae* and dominates in many places when the beech and oak have been destroyed.

The heavy, very hard and splintery wood of *C. betulus* is used for farming implements, machine parts and parquet-flooring. It is also used as fuel being highly calorific.

References: 4, 37, 103 (3), 104 (2), 141, 218 (1), 258.

42. *Carpinus orientalis* Miller

A small slow-growing tree, usually only attaining a height of 5 - 8 m, exceptionally 12 - 15, while it often may grow as a bush.

In Europe *C. orientalis* occurs in the Appenine peninsula, in Sicilia, on the Balkans and in the Crimea. Its most northern localities hardly go beyond 45° N. It is found in south-west Asia in Anatolia on the Black Sea, in the Caucasus and in north Iran, where in the east it penetrates to the end of the province of Gorgan. It can be also found in south Anatolia in the Taurus and Amanus mountains (İçel, Seyhan and Hatay provinces), as well as in north-west Syria where it reaches near Slenfe in the Jebel el Ansariye. The disjunction between its northern and southern range in Anatolia is about 250 km.

C. orientalis has a smaller distributional area than *Carpinus betulus* L. but in south-west Asia they overlap to a marked degree. From the ecological point of view the two differ: *C. orientalis* is more resistant to drought than *C. betulus* L., and being very photophyllic and thermophyllic, it mostly grows in open, sunny places, in dry, shallow and stony calcareous soils in xerothermic woods and scrubs, often together with spiny bushes, such as *Paliurus spina-christi* Miller.

Sometimes it occurs in the second storey in light oak and hornbeam (*Carpinus betulus* L.) forests or on their edges, and even in riparian forests. Pure communities of *C. orientalis* are rather secondary in character resulting from cutting down forests and the consequent drying of the soil.

Near human settlements where it has been eaten by goats and sheep and felled by the local population for fire wood *C. orientalis*, due to its capacity for growing off-shoots from the trunk up to old age, grows in a dwarfish (occasionally even prostrate) form with a great number of tiny thornlike twigs.

Altitudinally *C. orientalis* occurs in low mountains, not exceeding 1000 - 1200 m a.s.l. in Europe and in the Caucasus (in Armeniya even 1500 m). In Anatolia it reaches 1600 m, or even 1800 - 1900 m, and above 2000 m in Iran.

References: 4, 37, 52, 103 (3), 104 (2), 141, 218 (1), 258.

Corylus L.

43. *Corylus avellana* L.

Strong, erect shrub to 5 m high, sometimes growing as a tree up to 7 and even 10 m. A Euro-west Asiatic species, its area covering nearly all Europe — except the northern part of the Scandinavian peninsula, the southern part of the Iberian peninsula and the most northern and southern regions of European Russia where it extends almost as far as the Ural Mts. It also grows throughout nearly the whole of Turkey, in north-west Iran and in the Caucasus and Talish Mts. It is recorded from mountain forests of Cyprus, but it is not quite certain whether it is wild in the island or whether it is an escape from gardens, as it is cultivated extensively in the Pistillia valley.

C. avellana growth both in moist or even wet soils in forest brushwoods, and also on drier stony and rocky ground, especially with a calcareous substratum, in open and sunny places. It is found in all types of broad-leaved, mixed and coniferous forests, forming due to suckering, a compact understorey. It also grows in scrubs of different kind on slopes of river-valley, gorges and ravines. It tolerates shade well, but grows best in conditions of moderate light.

In the Caucasus it grows up to 2100 - 2300 m a.s.l. to the upper forest limit, but in Europe its highest localities (the Alps and the Bulgarian mountains) are situated not higher than 1600 - 1700 m. In Anatolia *C. avellana* is found from the actual shores of the Black Sea up to 1500 - 1700 m a.s.l. It is concentrated in the northern part of the country, though scattered localities are found in the south, most frequently in the Amanus Mts.

The species has been grown for a very long time because of its tasty fruit, in different selected forms, often of hybrid origin (*Corylus maxima* Mill., *C. pontica* C. Koch). The cultivation of hazel-nut trees has been developed economically in north Anatolia, especially in the provinces of Trabzon and Rize. As the cultivated forms often run wild it is rather difficult to determine whether a number of populations are natural or artificial.

References: 15, 37, 79, 103 (3), 104 (2) 141, 218 (1).

44. *Corylus colurna* L.

Tree usually growing up to 20 - 22 m, though in favourable conditions it can reach 30 m or more, with a trunk up to 1 m in diameter. It has a dense, compact, regular broad cone-shaped crown and a grey-brown scaling bark.

The area of *C. colurna* covers the Balcan peninsula (Albania, Jugoslavia, Bulgaria, Greece, south-west Romania and Turkey-in-Europe), north-west Anatolia, the Caucasus, Talish Mts. and north-west Iran where it is very rare.

Throughout its distribution *C. colurna* grows mostly singly in mixed broad-leaved forests, especially in hornbeam-oak and beech woods, seldom forming groups although such *C. colurna* woods covering 3 - 40

hectares are known in Armeniya (USSR). In Jugoslavian Macedonia this hazel grows on lower mountains, between 800 - 1300 m a.s.l., in Bulgaria not above 1200 m, but in Albania and Anatolia and on the Caucasus the highest localities are situated at 1600 - 1700 m.

A species which requires warmth though it is resistant to low temperature. It is mesophyllic, tolerating shade and thrives best in fertile, wet and deep soils, but also grows in alluvial terrain on river terraces and in calcareous soils. It has been cultivated since ancient time because of its tasty fruit. Though its nuts are small and have a thick shell, the tree bears an abundant crop. Moreover *C. colurna* is a very valuable decorative species.

C. colurna has been much decimated through excessive exploitation — it has been cut down for its valuable wood widely used in carpentry (furniture). It has mainly survived in impenetrable places and should be preserved.

References: 15, 37, 79, 91, 103 (3), 104 (2), 141, 218 (1).

45. *Corylus jacquemontii* Decne.

This is a species closely related to *Corylus colurna* L., with which it is frequently confused.

It is a small tree attaining about 15 m height. Its range is restricted to the most western part of the Himalayas, where the species is distributed from eastern Afghanistan (Nuristan, near Pashki) to western Nepal at an altitude of 1800 to 3300 m. In view of its considerable moisture requirements *C. jacquemontii* occurs primarily on northern exposure of mountain slopes mixed in shady coniferous forests with *Picea smithiana* (Wall.) Boiss., *Abies spectabilis* (D. Don) Spach, *Pinus griffithii* McClelland, *Cedrus deodara* (D. Don) G. Don, or in moist broad-leaved forests together with such species as *Aesculus indica* (Camb.) Hook., *Acer caesium* Wall., *Celtis caucasica* Willd., *Ulmus wallichiana* Planchon etc. On the southern slopes it is usually restricted to valleys of mountain streams, where it frequently occurs in larger groups forming thickets together with *Juglans regia* L., *Salix sericocarpa* N. J. Anderson and *Populus* spec. (sect. *Tacamahaca* Spach.).

The nuts of this hazel are an important food product throughout its range.

References: 15, 30, 37, 168, 179.

Ostrya Scop.

46. *Ostrya carpinifolia* Scop.

Tree usually 15 - 20, sometimes 25 m tall with a trunk to 50 cm in diameter. At high altitudes it grows in the form of a tall bush.

It is the only representative of the genus *Ostrya* in Europe and south-west Asia its distribution being much the same as that of *Carpinus orientalis* Mill. In south-east Europe it is found mainly in the Apennines and Balkans. Westwards *O. carpinifolia* grows in south-east France, in Corsica, Sardinia and Sicily, as well as in south Switzerland and Austria, mostly in low mountains, up to 1400 - 1500 m a.s.l.

In south-west Asia *O. carpinifolia* occupies three disjunct areas. The first is in north Anatolia, between Zonguldak and Bolu in the west and the provinces of Samsun and Tokat in the east. The second lies in north-east Anatolia and the adjoining west-Caucasian region of the USSR. The third is in south Anatolia, in the Taurus and Amanus mountains, in north-west Syria and in Lebanon. In this third area *O. carpinifolia* is found more often in the east than in the west.

On the whole it is a mesophyllic and somewhat shade-seeking species, growing best in fertile, deep and humid especially calcareous soils but it can also be found in dry localities in shallow soil. Sometimes it forms

pure communities as in the Amanus Mts. in Jebel Musa, but it usually occurs in the first or second storey of deciduous, or even coniferous forests.

O. carpinifolia is found most often at an altitude of (400) 500 - 1200 (1500) m a.s.l., but in some places, for instance, near Zonguldak and Sinop it occurs at 50 - 250 m a.s.l. The highest localities in Anatolia have been noted in the Amanus mountains and in the southwest Taurus at 1700 - 1800 m, and in the northern province of Erzurum at 2300 m. In the Caucasus *O. carpinifolia* sometimes reaches the sub-Alpine forests up to 2100 m (prostrate forms). In Lebanon it grows at an altitude of 1800 m.

Although the wood of *O. carpinifolia* has great potential it is not very important in industry as it is very scarce.

References: 103 (3), 104 (2), 141, 161, 218 (1), 258.

Ebenaceae

Diospyros L.

47. *Diospyros lotus* L.

Tree of average size, 20 - 25 m in height (sometimes even higher), trunk to 1 (1.5) m in diameter.

This species occupies three disjunct areas. The first is in central and southern China, where *D. lotus* grows at heights between 600 - 1300 m a. s. l. The second comprises the western Himalayas (from Kashmir to eastern Afghanistan), and some mountain ranges of Uzbekistan and Tadzhikistan in USSR (Darvazskiy Khrebet and Gissarskiy Khrebet). The natural occurrence of *D. lotus* in this part of Asia has often been questioned, there being an opinion that it was brought there as dried food by caravans wandering westward from China along the so-called silk road. This opinion is, however, controversial.

The third, westernmost area stretches from north-east Iran (Gorgan province), along the shore of the Caspian Sea and the Caucasus into northeast Anatolia, but most probably not farther west than the Giresun region.

D. lotus is quite common, and it even forms pure woods, as, for instance, in south-east Azerbaydzhan in USSR, in Lenkoran province. It is found in different types of Caucasian forests more or less mixed with hornbeam, beech, alder and elm trees. In the past *D. lotus* occurred much more frequently, but it has been greatly destroyed both because of its valuable hard wood, and its felling by natives in order to gather more easily its edible fruit. It usually grows in lower mountain sites — in Anatolia from almost the actual sea-shore up to 600 - 700 m a.s.l. and in Iran to 1100 m where it is a component of forests lying near the Caspian Sea growing together with *Alnus subcordata* C. A. Mey., *A. glutinosa* (L.) Gaertn. subsp. *barbata* (C. A. Mey.) Yaltirik and *Pterocarya fraxinifolia* (Poir.) Spach; it is also found in oak and beech forests.

In Middle Asia *D. lotus* does not form any compact and large communities, but grows as single specimens or in small groups in different kinds of gorges — damp and protected from cold winds, at heights between 1000 - 2000 m a.s.l. It occurs together with such species as *Fraxinus sogdiana* Bunge, *Juglans regia* L., *Prunus divaricata* Ledeb., *Celtis caucasica* Willd., *Crataegus pontica* C. Koch, *Cerasus mahaleb* (L.) Miller etc. *D. lotus* grows in eastern Afghanistan up to 2100 m a.s.l. but its localities there are few in number and rather dispersed, the same situation being found in Pakistan and Kashmir.

D. lotus is a tree tolerating shade well, though then it yields less fruits which matures later. Though it grows in all kinds of soil, it can be found most often in wet, deep and fertile soils, especially near rivers and streams.

In nearly all these countries mentioned above this species is grown as a fruit-tree. Its fruits, about 2.5 cm in diameter, is edible, containing great amounts of sugar, but also tannic compounds that give it a tart taste. It is eaten fresh after autumn frosts or dried, and is used in different kinds of food. In Afghanistan a drink is made of it, rather like sherbet. Apart from occurring naturally *D. lotus* is cultivated in many Mediterranean countries in Europe, in India and in Japan.

References: 18, 30, 64 (6), 100, 179, 194, 252.

Fagaceae

Castanea Miller

48. *Castanea sativa* Miller

Syn.: *C. vesca* Gaertn.

A long-lived tree growing to a height of 30 - 35 m, with a trunk 1.5 - 2 m in diameter. Old, single specimens are often much thicker, and, for instance in Italy, there are specimens with a circumference of 20 - 23 m at ground level.

This species because of its edible nuts and valuable wood has been cultivated for ages and has been naturalized in many countries of south and central Europe making its natural area of distribution difficult to determine. It is often assumed that it does not grow wild in Europe, but became naturalized, after introduction by the Greeks from Asia Minor. Lately it has been postulated that the area of *C. sativa* in Europe covers Italy, south Austria, south-west Hungary, Yugoslavia, Albania, west Bulgaria (only a few localities) and Turkey-in-Europe, as well as Greece where on the Peloponnisos and Crete the localities are most probably not natural.

In south-west Asia the area of *C. sativa* is limited to west and north Anatolia, the central and north Caucasus and north Iran (only two localities in Gilan province near the Caspian Sea). This distribution shows clearly that the occurrence of the chestnut depends much on air humidity and rain-fall. *C. sativa* is a typical mesophyte, needing over 600 mm of annual rain-fall and a fertile, deep, well drained soil. A thermophilous species, usually a calcifuge, tolerating shade well.

In south-west Asia it occurs right from sea-level to about 1600 - 1700 m a.s.l., but its optimal conditions are between (300) 500 - 1200 m. At lower altitudes it forms a more or less distinct zone of chestnut forests (*Castanetum sativae*), pure or mixed with hornbeam, elm, linden, maple, beech, hazel and sometimes with oak or plane. In Europe the highest localities of *C. sativa* are found in Bulgaria at about 1000 m a.s.l. while in Albania and Yugoslavia it grows to 1200 m and in Greece to 1500 m.

This chestnut is one of the most valuable forest trees in Anatolia and in the Caucasus. In Turkey it occupies about 1.4 percent of the total forested land. Its wood which is rather hard and not very heavy is tough and resistant to moisture; it contains a great quantity of tannins. The nuts are very valuable, edible either fresh or boiled or baked. In some countries *C. sativa* is cultivated for its nuts forming a very important branch of agricultural production (Italy, Spain, France). In these countries there are many varieties with large and tasty nuts and yielding abundant fruit.

References: 9, 12, 103 (3), 104 (2), 141, 218 (1).

Fagus L.

49. *Fagus orientalis* Lipsky

A splendid forest tree, growing to a height of 40 m or even more and with a bare trunk achieving a diameter of 160 cm.

One of the most important forest species in the Caucasus (about 25 percent of the total forested land), in Turkey (ab. 8.5 percent) and in north Iran. *F. orientalis* occurs in Europe — in south Crimea and the Balkans. A clear delimitation of area in the Balkans is very difficult, as introgressive hybridization with the European beech *Fagus sylvatica* L. occurs. The transitional zone between these two taxa is very wide and covers a large part of Bulgaria, Romania, Greece, Yugoslavia and Albania and the intermediate beech forms are sometimes treated as and independent species — *Fagus moesiaca* (K. Maly). Czecz.

F. orientalis is a mesophyllic and shade-seeking tree, whose occurrence depends not only on soil conditions, but on humidity and rainfall. In the regions where it grows the total annual rainfall is over 500 - 600 mm, while the degree of moisture in the air is over 70 percent. As the climate becomes drier and more continental the species gradually decreases, or grows at higher levels. It forms either pure stands (*Fagetum orientalis*) or mixed ones with other mesophyllic trees and shrubs, both deciduous and coniferous.

In Anatolia the range of beech forests covers two main areas separated by a dry region in the centre of the country. The first extends along the shores of the Black Sea in the north as an almost unbroken belt from Turkey-in-Europe in the west to the border with USSR in the east. Here *F. orientalis* penetrates slightly, southwards to Murat Dagi, a mountain massif situated on the border line between the provinces of Kütahya and Uşak (ab. 38°54' N). Though occasionally, especially between Istanbul and Zonguldak, it is almost at sea level, dense beech stands are mostly found in mountain zones between 1000 - 1800 (1900) m a.s.l., and even to 2200 m (e.g. Ulu Dag). In the brushwood of such beech forests there are evergreen shrubs such as *Rhododendron ponticum* L. (sometimes very abundantly), *Laurocerasus officinalis* Roem. and species of *Ilex* and *Hedera*. The beech forms mixed stands with *Carpinus betulus* L. and with *Abies nordmanniana* (Stev.) Spach (all three subspecies).

In the south of Anatolia *F. orientalis* covers the north and central part of the Amanus mountains, and part of the Taurus mountains (provinces of Maraş, Seyhan and Hatay). Here the beech is found more or less between (500) 900 - 2000 m a.s.l.

In north Iran in the Hyrcanian Forest at the Caspian Sea, in the provinces of Gilan, Mazandaran and Gorgan, *F. orientalis* was the dominant species, but because of great devastation its place has often been taken by other mesophyllic species - at lower altitudes chiefly by *Parrotia persica* C. A. Mey. and at higher altitudes by *Carpinus betulus* L. and oaks. Beech forests are found from 1000 to 2200 m a.s.l. on the northern slopes of the Elburz Mts., occasionally growing lower down.

The centre of the area of *F. orientalis* is in the Caucasus, mainly in its western part, where, thanks to great humidity the species grows right down to sea-level (Black Sea), while between 1000 - 1500 m it forms a separate zone. In east Transcaucasus the lower limit of its occurrence is 800 - 900 m a.s.l. due to the climates becoming very continental. The gnarled forests of *F. orientalis* in the Caucasus reach 2200 - 2300 m a.s.l.

The wood of the beech is very valuable and is used in many ways mainly in the chemical and furniture industries. It is used as a fuel with a high calorific content.

References: 48, 60, 61, 103(3), 104(2), 125, 141, 160, 235.

Quercus L.

Oaks form a group of trees in south-west Asia the taxonomy of which is unquestionably the most difficult (as are such genera as *Tamarix*, *Crataegus* or *Cotoneaster*). There are many reasons for this. On the one hand the species are very polymorphic, and on the other, they form hybrids easily, and it seems that introgressive hybridization among some species is rather frequent. The herbarium material taxonomists have at their disposal is often represented by non-typical specimens collected from plants permanently bitten by sheep and goats or burned or cut by local inhabitants for fuel or fodder (young twigs and leaves). Such trees are often characterized by deformed leaves that do not resemble the species at all; moreover fruit is missing - an important diagnostic element. Errors in defining such collections are very frequent.

Because of this situation over 70 species of variable taxonomic value have been described from the region of south-west Asia, and above all, from Turkey and Iran. Though several analytical works on oaks from this part of Asia have been published the opinions among the authors are greatly discordant. Some species are taken to be synonyms of others or considered as subspecies or varieties, and not always linked with the correct species.

From among the many treatises on oaks in south-west Asia the publications of Kotschy [140], Wenzig [240], Schwarz [210, 212], Camus [54], Djavančir [69, 70], Zohary [255] and Menitsky [48, 155] are worth mentioning. This present study is mainly based on the conception of Menitsky. It is most critical and treats the species on a broad scale, their biological properties being fully understood.

50. *Quercus alnifolia* Poech

This evergreen can be either a shrub or a small tree which in exceptionally favourable conditions can attain 8 - 10 m in height with a trunk about 70 to 90 cm in diameter. Its range is restricted to Cyprus, to the regions of igneous rocks in the mountains of the southern and western part of the island (Paphos Forest, Troodos Forest, Makhearas Forest, Limassol Forest). In that area is a very common species, forming in places, dense thickets difficult to traverse, either pure or mixed with *Acer syriacum* Boiss. et Gaill., *Quercus coccifera* L., *Arbutus andrachne* L. nad *Pistacia terebinthus* L. It occurs also in the shrub layer of pine forests (*Pinus halepensis* Miller, *P. nigra* Arnold) or cedar (*Cedrus libani*) A. Richard subsp. *brevifolia* (Hook f.) Meikle).

Q. alnifolia plays a considerable protective role, preventing landslides and soil erosion. It can occur between 450 and 1800 m although it is usually found from 600 to 1400 m. It is the main source of fire wood for the local population. The wood is hard and durable and is widely used for wagon building, tools, etc., as well as for the production of a high quality charcoal.

The species is endemic to Cyprus.

References: 54(1), 56, 113, 155, 212, 255.

51. *Quercus baloot* Griff.

An evergreen, strongly branched tree, about 12 - 13(15) m tall with a trunk circumference of 1.5 - 1.8 m; frequently a high shrub. *Q. baloot* is closely related to the Mediterranean species *Quercus ilex* L., therefore both oaks have often been treated together, especially in old literature [30, 114].

The rather small distributional area of *Q. baloot* is restricted to the east regions of Afghanistan, from more or less 69° E through north Pakistan, Kashmir to north-west India. In India, along the middle course of the river Sutlej, only a few localities are found beyond 78° E. The northern limit of the species is marked roughly by the southern foothills of the Hindukush and Karakoram, while the south limit runs approximately along the river Kurram to the foot of the Himalayas. Altitudinally *Q. baloot* grows from about 500 to over 3000 m a.s.l., occurring most often between 1000 - 2500 m a.s.l. One of its highest localities — about 3300 m is in Afghanistan in the region of Safed Koh.

A very photophilous species which is very resistant to both low temperatures and long-lasting drought. It grows mostly on dry, stony slopes of river valley, on mountain sides, etc. It frequently forms pure communities. According to water conditions these are either open woodlands or true forests. In Afghanistan the communities of *Q. baloot* form an extensive altitudinal belt between 1300 - 2000 m.

At lower altitudes, between 600-1300 m *Q. baloot* occurs with such species as *Olea ferruginea* Royle, *Pistacia chinensis* Bge. subsp. *integerrima* (J. L. Stewart) Rech. f., *Celtis caucasica* Willd., *Acer pentapomicum* J. L. Stewart, *Cotinus coggygria* Scop., *Punica granatum* L., *Fraxinus xanthoxyloides* (Wall.) DC., *Sageretia thea* (Osb.) M. C. Johnst. — the association being treated as an *Olea ferruginea-Quercus baloot* communities. In regions with rather high air humidity, in the Himalayan part of its area, *Q. baloot* grows quite often in light coniferous forests, where *Pinus roxburghii* Sargent predominates. It grows here together with such evergreen species as *Quercus incana* Roxb., *Pieris ovalifolia* D. Don, *Rhododendron arboreum* Sm., *Pyracantha crenulata* (Roxb.) Roem., etc.

Though *Q. baloot* is quite a common species it is not economically important because of its rather small, frequently irregular, trunk. The wood is used as fuel. Leaves and young twigs are utilized as fodder while young branches with mucronate leaves are made use of in building fences in villages.

References: 30, 32, 48, 54(1), 58, 88, 155, 170, 214.

52. *Quercus brantii* Lindl.

Syn.: *Q. persica* Jaub. et Spach, *Q. aegilops* L. subsp. *brantii* (Lindl.) A. Camus

A small tree, 8 - 10 m tall, with a trunk 50 - 80 cm in diameter. An Irano-Turanian species.

One of the most characteristic oaks in southern regions of south-west Asia. It follows the mountains of the Amanus and Anti-Taurus in Anatolia through Jebel el Ansariye in north-west Syria to the mountains of north Iraq and Zagros chain in south-west Iran reaching as far south as the province of Fars (near Shiraz).

In the mountains *Q. brantii* forms pure, loose, xerophilous forest communities on calcareous slopes which give directly on to the steppe where the two plant formations intermingle. In such forest-steppes occur also *Pistacia atlantica* Desf. subsp. *kurdica* (Zohary) Rech. f., *P. khinjuk* Stocks, *Pyrus syriaca* Boiss., *Crataegus aronia* (L.) Bosc., *Cerasus microcarpa* (C. A. Mey.) Boiss., *Acer monspessulanum* L. (especially subsp. *cinerascens* (Boiss.) Yaltirik), *Paliurus spina-christi* Miller, *Lonicera nummulariifolia* Jaub. et Spach and in some places *Juniperus oxycedrus* L., *Daphne mucronata* Royle and *Amygdalus scoparia* Spach. In Iraq *Q. brantii* forms forests together with *Quercus infectoria* Oliv. subsp. *boissieri* (Reut.) O. Schwarz and dependent on local conditions one or other of the oaks dominantes. In the most southern areas of its distribution (e.g. Jabal Sinjar in Iraq) it is sometimes the only oak species represented and even the only tree.

Forests of *Q. brantii* are found between (600) 800 - 1600 (1800) m a.s.l., but sometimes it grows at lower altitudes, for instance, in Anatolia, in the province of Mardin — at a height of 350 m. The highest localities are known in Iran, near Shiraz — 2300 m and Kermanshah — 2700 m.

Q. brantii is a polymorphic species and a number of taxa have been distinguished in it classified either as varieties or subspecies or indeed treated as separate species. The taxonomists, however, do not agree on their value: probably some represent only hybrids of *Q. brantii* with *Q. infectoria* Oliv. and *Q. libani* Oliv.

The acorns of *Q. brantii* dried and ground with the addition of flour are used in backing bread by the population of mountain regions in west Iran, and the cupules are utilized in tanning.

References: 6, 48, 54(1), 69, 155, 161, 210, 212, 255.

53. *Quercus castaneifolia* C. A. Mey

A huge tree, growing to 40 m, and even 50 m in height, and with a trunk diameter of 120 - 150 cm. One of the characteristic forest-forming species of the Hyrcanian Forest, occurring almost exclusively in the region of the Talish Mts., and on the north side of the main ridge of the Elburz Mts. (Prov. Gilan, Mazandaran, Gorgan); the few localities that do occur isolated from the main area of distribution are found in north-east Azerbajdzhan (USSR) in the district of Ismailly. Formerly this oak was more abundant than it is now, but because of intense felling it has been replaced by other species, especially *Parrotia persica* C. A. Mey, and *Carpinus betulus* L.

In Iran *Q. castaneifolia* can be met from coastal plains up to 2400 m, but the best conditions for its development are between 200 and 1200 m. It is a dominating species and forms either pure stands or mixed ones with such species as *Carpinus betulus* L., *Zelkova carpinifolia* (Pall.) C. Koch, *Parrotia persica* C. A. Mey., *Acer velutinum* Boiss., *Diospyros lotus* L., *Gleditsia caspica* Desf. and *Buxus hyrcana* Pojark. (in undergrowth), and lower down with *Pterocarya fraxinifolia* (Poir.) Spach and species of *Alnus*.

Q. castaneifolia grows in various kind of soils, but best of all in fertile, wet and rather deep soils. It is a mesophyllic species, but can well withstand even long periods of drought; it is not resistant, however, to too much water in the soil.

A rather variable species, especially as regards the depth of incisions between the teeth, the termination of the teeth, leaf pubescence and the form of the scales on the cupule. Because of this, a number of subspecies have been distinguished through their taxonomic value is questionable. — they are only forms that show neither geographic nor ecologic correlation.

References: 6, 48, 54(1), 69, 103(3), 104(2), 155, 205, 218(1), 255.

54. *Quercus cerris* L.

Syn.: *Q. austriaca* Willd., *Q. tournefortii* Willd.

Tre 30 - 35 m tall with a trunk over 1 m in diameter; single, old specimens sometimes have trunks 5 - 5.5 m in circumference.

One of the very important forest species in south-east Europe, and in north-west, west and south Anatolia. It goes as far south as the mountains of south Lebanon. The northern limit of its area in Europe runs across south-east Switzerland, north Yugoslavia and south Czechoslovakia, while the western one reaches more or less the west border of Italy.

Q. cerris is a moderately mesophyllic species, growing well in rather deep, light, sandy or stony soils, seldom found in calcareous soils. It forms either pure or mixed stands, mainly with other oaks such as *Quercus frainetto* Ten., *Q. pubescens* Willd., *Q. petraea* (Mattuschka) Liebl., *Q. pedunculiflora* C. Koch, *Q. macrolepis* Kotschy, *Q. trojana* Webb, or *Q. libani* Oliv. Besides it also occurs, especially in Europe with *Castanea sativa* Miller, *Carpinus betulus* L. and *C. orientalis* Miller.

In north-west Anatolia it is an intrusive species growing at low altitudes after the cutting down of beech forests. In mountainous Mediterranean mesophyllic forests, above 1000 m a.s.l. *Q. cerris* is often the chief constituent. In rather dry localities it is replaced by other oaks, or becomes a constituent of pine forests (*Pinus brutia* Ten.). Remnants of this oak together with *Quercus pubescens* Willd. are widely scattered in central parts of Anatolia; these are very definite communities forming transition between woodland and timberless steppe.

In Europe *Q. cerris* is found from the lowlands up to about 1500 m a.s.l., in Anatolia mostly between 500 - 1500 m, although in the north it grows at sea-level and in the Amanus mountains to 2000 m. In Lebanon it is found between 1300 - 2200 m.

A species very variable in the depth of the incisions between the leaf lobes, a characteristic so changeable that it seems aimless to distinguish ultraspecific taxa.

The wood of *Q. cerris* is utilized as timber and railway-sleepers, and as a valuable fuel.

References: 54(1), 155, 161, 210, 255.

55. *Quercus coccifera* L.

An evergreen shrub or small tree, in favourable conditions growing up to 5 - 6 m, and in extreme ones even to 15(20) m.

A species very variable in the size and shape of its acorns, and in the arrangement and form of scales on the cupule. Due to this a number of varieties have been distinguished, which, it would seem, are not very important from the taxonomic point of view, as they occur side by side in the same locality. *Q. coccifera* is usually divided into two subspecies (or varieties) — subsp. *coccifera* and subsp. *calliprinos* (Webb) Menits., the latter often being treated as an independent species *Quercus calliprinos* Webb. Supposedly *Q. coccifera* subsp. *coccifera* occurs in the western part of the area extending to south-west Anatolia in the east, while subsp. *calliprinos* covers eastern regions. It is also characterized by more elongated leaves and better growth and by growing at higher altitudes. The transitional zone between the two subspecies is very wide and as yet not precisely defined.

Q. coccifera is a common Mediterranean species distributed all over south Europe (in Italy in the south only), in north Africa and in the west part of south-west Asia.

In Anatolia *Q. coccifera* occurs along the shores of the Aegean and Mediterranean Seas only sometimes going inland (west Anatolia). However, single localities are also known disjunct in north Anatolia. *Q. coccifera* hardly 1 - 1.5 m high is a constituent of seaside maquis and phrygana beside such tree and shrub species as *Ceratonia siliqua* L., *Pistacia lentiscus* L., and *P. terebinthus* L., *Quercus infectoria* Oliv., *Calicotome villosa* (Poir.) Link, *Olea europaea* L., *Phillyrea latifolia* L., *Arbutus unedo* L., and *A. andrachne* L., *Smilax aspera* L. and *S. excelsa* L., *Genista acanthoclada* DC.; *Erica arborea* L. and *E. manipuliflora* Salisb., *Juniperus oxycedrus*

L. and in places *J. phoenicea* L., too. As understorey it is also found in light pine forests (*Pinus brutia* Ten., *P. halepensis* Miller) while in degraded forest places, especially on calcareous, sunny slopes it forms pure very dense communities (*Quercetum cocciferae*) in which other species of woody plants are very limited. Altitudinally it grows right from sea level to 500 - 800 m, but in some places, especially on the south side of the Taurus and Amanus Mts. it is found up to 1200 - 1300 m; on Cyprus it grows only to 1000 - 1500 m.

In Syria, Lebanon, Israel and Jordan *Q. coccifera* is said to be represented by subsp. *calliprinos* only, and here more often than in the previous region arborescent specimens are found, mostly in protected places — in cemeteries, and in places of religious cult (sacred trees), where the largest recorded has a trunk in circumference of 7 m. In Palestine *Q. coccifera* is the commonest tree or shrub in maquis and forest, forming pure communities or mixed with *Pistacia palaestina* Boiss. or *Juniperus phoenicea* L., mainly on terra rosa, rendzina, and sandy soils, usually above 200 m a.s.l. In Lebanon the highest localities are at height of about 1600 m and in Jordan (Edom) even about 1700.

The low growth of *Q. coccifera* is caused by constant topping of this oak (for fuel and charcoal), by grazing (goats and sheep), by burning out and by hard habitat conditions (barren soils).

References: 54(1), 66, 98, 155, 161, 210, 240, 255.

56. *Quercus frainetto* Ten.

Syn.: *Q. conferta* Kit.

Tree to 30 - 36(40) m high, the trunk 3.5 in circumference. This oak is closely related to *Quercus macranthera* Fisch. et C. A. Mey. and it may well be that published data on its most eastern localities refer to that species.

A Balkan species, its distribution covers a very considerable area in Yugoslavia (especially the south), Greece, Albania, Bulgaria, south and west Romania and Turkey-in-Europe. Beyond the Balkans it is found in south and central Italy and in north-west Anatolia. Farther north it spreads to north-west Romania and, may be, to south-west Czechoslovakia although the status of its localities there is uncertain.

A typical species of forest tree, growing fast, characterized by a great resistance to drought (more so than *Quercus cerris* L.). In Anatolia, where it is common in the province of Izmit and Bolu, it forms either pure stands or mixtures with other species of oak, chiefly *Quercus cerris* L. and *Q. pubescens* Willd., and with *Tilia tomentosa* Moench, *Carpinus orientalis* Miller, *Corylus avellana* L., *Mespilus germanica* L., *Cornus sanguinea* L., etc. It occurs in lowlands and low mountain regions, usually only up to 1000 m a.s.l. (exceptionally to 1200 - 1300 m). In Bulgaria it grows up to 1000 m, in Albania to 1100 m, in Greece to 1400 m and in Yugoslavian Macedonia even to 1600 m. It forms hybrids with *Quercus cerris* L., *Q. pubescens* Willd. and *Q. petraea* (Mattuschka) Liebl. (s. 1).

In countries where this oak grows its wood is very valuable in the same way as the wood of other European species (*Quercus petraea* (Mattuschka) Liebl., *Q. robur* L.). It is usually utilized as building material, to make railway-sleepers, in the mining industry, and as a very useful fuel.

References: 54(1), 66, 90, 91, 155, 210, 212, 255.

57. *Quercus hartwissiana* Steven

Syn.: *Q. armeniaca* Kotschy, *Q. stranjensis* Turrill

A Euxinian species of oak growing to 25 (35) m in height. It occurs in a rather narrow belt along the southern and eastern shores of the Black Sea, mainly in the USSR where it is recorded from Krasnodar province, from Abkhazskaya ASSR, from Colchis, Imeretia and Adzhariya. It is distributed there right at sea level and in lower mountain areas occurring up to 1200 - 1400 m a.s.l., but only in places where it finds suitable conditions (above all dampness), for instance along river valleys. It usually grows in mixed woodland of oak, hornbeam, alder and beech, seldom forming pure, small populations.

In north Anatolia *Q. hartwissiana* is probably more widely dispersed than the dot map suggests. Based on its distribution in the Caucasus it would be expected to grow along the whole north shore of Turkey especially on alluvial plains in damp and mesophyllic forests. In the district of Samsun it is found even in swampy forests, where *Fraxinus excelsior* L. and *Alnus glutinosa* (L.) Gaertn. dominate. Altitudinally it does not grow in Turkey beyond 1000 - 1300 m, exceptionally a little higher.

In Europe it seems to grow only in the Istranca Mountains (Bulgaria, Turkey) as a constituent of the so-called Longos Forest, which develops best near estuaries. It needs deep and damp soils and a lot of rainfall, to 1000 - 1200 mm.

Q. hartwissiana can be placed between *Quercus robur* L. and *Q. petraea* (Mattuschka) Liebl. in its morphological features and quite often no distinction to draw between them. Because of this the information on this distribution, especially within Turkey, is unsatisfactory.

References: 54(2), 103(3), 104(2), 155, 212, 218(1), 255.

58. *Quercus ilex* L.

Tree 20(25) m tall, usually with a short trunk and a crown set low. An evergreen, Mediterranean oak species spreading over south Europe and north Africa, where to a large extent its area covers that of the cultivated olive (*Olea europaea* L.).

The eastern limit of its area is in Anatolia in the Black Sea provinces of Zonguldak, Sinop and Samsun though here it is very rare known only from a few localities disjunct from the Mediterranean stations where it occurs, on the shores of the Aegean Sea (especially Samsun Dagi). Nowhere does it penetrate inland.

In the Mediterranean it is very common on northern slopes, growing up to 300 - 400 m a.s.l. with such species of trees and shrubs as *Platanus orientalis* L., *Fraxinus ornus* L., *Laurus nobilis* L., *Pinus brutia* Ten., *Styrax officinalis* L., *Arbutus unedo* L. and *A. andrachne* L., *Phillyrea latifolia* L., *Pistacia terebinthus* L., *Quercus coccifera* L., etc. At the Black Sea it appears from the shores to about 100-140 m a.s.l. forming small groves where it is the dominating species (for instance near Alapli). It grows with *Laurus nobilis* L., *Mespilus germanica* L., *Ostrya carpinifolia* Scop., *Carpinus betulus* L. and *C. orientalis* Miller, *Corylus avellana* L., *Phillyrea latifolia* L., *Sorbus torminalis* (L.) Crantz, *Erica arborea* L., *Herdera helix* L., *Smilax excelsa* L., etc.

References: 54(2), 66, 155, 159, 210, 255.

59. *Quercus infectoria* Oliv.

Semi-evergreen shrub or low tree growing to 8 - 10 m high. This species is very variable in the indumentum of the young shoots and leaves, in the leaf shape and in its margin, which may be entire, dentate or even lobulate. These characters vary both within population or on one individual. In addition *Q. infectoria* crosses easily with other species, especially *Quercus petraea* (Mattuschka) Liebl. (s.l.), *Q. pubescens* Willd. and *Q. macrolepis* Kotschy; it may be that introgressive hybridization takes place too, so that infraspecific division of this taxon and its relationships are not really clear. Usually two subspecies are distinguished: a western - subsp. *infectoria*, and an eastern - subsp. *boissieri* (Reut.) O. Schwarz.

Q. infectoria subsp. *infectoria* is found in nearly all west, north and south Anatolia and is also represented in Europe where it grows on Euboea island, in Greek Thrace and in Turkey-in-Europe. Usually a shrub 1.5 - 2 m high forming xerothermic bushwood of maquis type or open scrubs composed of different oak species, it can be found too in the undergrowth of pine forests (*Pinus brutia* Ten.).

The other subspecies - subsp. *boissieri* is limited to south Anatolia (Taurus, Anti-Taurus, Amanus), Kurdistan in Iraq and Iran (Zagros Mts.), Cyprus, west Syria, Lebanon, Israel and north-west Jordan. It is also recorded from south Transcaucasus. Its southern limit is near the Judean Mts. in central Israel.

It forms pure communities or grows mixed with other oak species, especially with *Quercus brantii* Lindl. (Kurdistan) or *Q. libani* Oliv., as well as with *Q. coccifera* L. (Palestine). It is common in the Amanus Mts., on mount Cassius (on the border-line of Turkey and Syria), and in the Lebanon and Anti-Lebanon mountains. There is a considerable overlap between the two subspecies and their individual limits are not yet well defined.

The type subspecies is found at lower altitudes, mostly below 800 - 1000 m a.s.l., while subsp. *boissieri* grows in Iraq to 1500 - 1800 m, and in Iran to 1850 m a.s.l.

References: 48, 54(2), 154, 155, 161, 210, 212, 254, 255.

60. *Quercus libani* Oliv.

A small tree growing to the height of 10 - 12 m, with characteristic ovate-lanceolate mucronulate-serrate leaves, with 10 - 15 pairs of parallel nerves. The leaves are very variable both in size and indumentum of the lower surface. The shape of the scales on the cupule, and their arrangement is also variable.

The area of *Q. libani* covers mainly the mountains of the central and eastern Taurus and the Amanus mountains in Anatolia, and the mountains of north-east Iraq. It is also found in west Iranian Kurdistan and north-west Syria. It is often recorded from Lebanon, but in spite of its name it does not grow in that country at all (see Mouterde, 163).

One of the most characteristic oak-trees of east Anatolia and Iraq, where it forms associations on its own - *Quercetum libani*, or with *Quercus infectoria* Oliv. subsp. *boissieri* (Reut.) O. Schwarz - *Quercetum infectoriae-libani*. In these forests, usually on western mountain slopes, in warm, clayey-calcareous soils shrubs such as *Juniperus oxycedrus* L., *Cerasus microcarpa* (C. A. Mey.) Boiss., *Cotoneaster nummularia* Fisch. et Mey. and *Rhus coriaria* L. are found. *Q. libani* grows, as a rule, above 1000 m a.s.l., the best conditions being between 1200 - 1600 (1800) m a.s.l. In the mountains of south Anatolia, in Ahir Dagi and Herakol Dagi it is even found above 2000 m.

The western limit of *Q. libani* is in the province of Konya in Anatolia; farther westward it is replaced by *Quercus trojana* Webb a species closely related and possibly better treated as a subspecies. The northern limit of the area reaches 40° north, in the province of Erzincan.

References: 48, 54 (1), 69, 155, 161, 212, 255.

61. *Quercus macranthera* Fisch. et C. A. Mey.

Tree up to 20 - 25 m high, though usually much lower, with a short, thick trunk and a wide, vigorously branched crown.

A Caucasian species, widely spread in the massifs of both the Greater and Lesser Caucasus and penetrating into north Iran on one side and north Anatolia on the other. In the latter it is represented by subsp. *syriensis* (C. Koch.) Menits., differing from the typical subspecies - subsp. *macranthera* in having a feeble growth (a strong shrub or a small tree) and leaves nearly half the size.

This oak is resistant to drought and low temperatures, very photophyllic. It grows mostly in localities with a continental climate, on dry, stony, often very steep, southern slopes. This is as a rule, in high montane stations its lower altitudinal limit in west Transcaucasus being at about 1000 m. In this region it does not form large concentrations, but grows singly or in small groups. As it goes east *Q. macranthera* is found in mountain forests, more and more frequently forming pure stands of quite large areas. This oak reaches 2300 - 2400 m in the alpine forest zone of west Transcaucasia and up to 2650 m in the east.

In north Anatolia *Q. macranthera* grows west to the province of Zonguldak, but here it is much scarcer than in the Caucasus and their neighbouring Turkish province of Artvin. In Anatolia it is found between (800) 1000 - 2000 m a.s.l.

In north Iran at the Caspian Sea *Q. macranthera* occurs mainly in the province of Mazandaran, in the central Elburz. Being more xerophytic than *Quercus castaneifolia* C. A. Mey. it forms forest above the main stands of that oak, at over 1400 m; the highest record (3000 m) being from Kuhe-Takht-e-Soleyman. In Iran communities of *Q. macranthera* adjoin or penetrate into subalpine tragacanthic dwarf shrub formations. To the east it is recorded from the National Park situated east of Gorgan (c. 56° E.).

References: 48, 54 (1), 69, 103 (3), 104 (2), 155, 212, 218 (1), 255.

62. *Quercus macrolepis* Kotschy

Syn.: *Q. aegilops* auct., *Q. vallonae* Kotschy, *Q. pyrami* Kotschy, *Q. ungeri* Kotschy, *Q. ehrenbergii* Kotschy

Tree to 15 (20) m tall, with a trunk 60 - 100 cm in diameter though usually not higher than 5 - 12 m.

In Europe this oak is only known from the southern Balkans (Albania, Greece, Turkey) and from the most south-eastern part of Italy (Puglia). Although recorded from Crete it is not native there (most probably it is only cultivated).

In south-west Asia *Q. macrolepis* is represented by two subspecies. The area of the typical subspecies – subsp. *macrolepis* covers west and south Anatolia, while isolated localities are also known from the province of Ankara. It occurs very frequently in the western part of its area, especially in the provinces of Çanakkale, Balıkesir, İzmir and Uşak. Eastwards its presence becomes rarer and more dispersed, the most easterly record being from the province of Siirt. The best conditions for its development are at low altitudes, between 300 - 900 m a.s.l., and at this level it is most concentrated but it does grow right from the shores of the Aegean Sea while in the Taurus Mts. it is found at a height of 1600 - 1700 m.

Q. macrolepis forms pure stands or grows mixed with other oak species or with *Pinus brutia* Ten. The pure stands are probably artificial formed by cutting out other trees to facilitate the collection of cupules and acorns. In Anatolia the forests of *Q. macrolepis* cover about 250,000 ha, but the species is also found singly near farm-houses and in fields where the trees seem to be remnants of destroyed forests.

The other subspecies – subsp. *ithaburensis* (Decne)* (often taken as an independent species – *Quercus ithaburensis* Decne.) grows in more southern regions. In south Anatolia, where it is rather scarce, it forms forests in alluvial plains and on lower slopes of the Taurus and Amanus mountains, in the province of Seyhan, Maraş, and Hatay. The main area for this subspecies is, however, west Syria, Lebanon, north Israel and north-west Jordan. Here it forms park-like forests, poor in arboreal species mostly from 0 - 500 m a.s.l., though rarely to 1000 - 1200 m.

The wood of *Q. macrolepis* is not very valuable, and is utilized locally on farms. The cupules, 6 cm in diameter, with a tannin content of 33 - 35 per cent are collected in Turkey and exported. Large, heavy acorns are utilized as valuable fodder.

References: 54 (1), 66, 74, 121, 155, 161, 210, 212, 235, 254, 255.

63. *Quercus pontica* C. Koch

Sturdy shrub or a small tree to 5 - 7 m tall with a trunk diameter to 30 - 40 cm. The trunk is often procumbent, characteristically branched from the very base.

The area of *Q. pontica* is limited to a rather small region, a narrow range of mountains stretching along the east shores of the Black Sea. Most of this lies in the USSR, in Trans-Caucasia, Georgia (Abkhazskaya ASSR, Adzhariya) delimited in the north by the basin of the river Byzb. In Anatolia it is much scarcer stretching westwards to the districts of Rize and Trabzon. The lower limit of its distribution is more or less 1200 - 1300 m,

**Q. macrolepis* Kotschy subsp. *ithaburensis* (Decne.) Browicz comb. nova = *Q. ithaburensis* Decne, in Ann. Sci. nat. Paris, 2 Sér. 4 : 348 (1835); *Q. aegilops* L. subsp. *ithaburensis* (Decne.) Eig, Beih. Bot. Centralbl. 51,2 : 228 (1933).

with the upper 1800 - 2100 m. The area of *Q. pontica* resembles that of *Betula medwedewii* Regel, and the two species often form common communities.

Q. pontica requires a lot of light so it is found mostly in open places as pure small woods with an undergrowth formed by such evergreen shrub species as *Rhododendron ponticum* L. and *Laurocerasus officinalis* Roem. Higher up it is found in sunny beech-woods (*Fagus orientalis* Lipsky). It needs fertile, humid, slightly acid soils and a remarkably moist atmosphere.

References: 54 (1), 103 (3), 104 (2), 155, 210, 212, 218 (1).

64. *Quercus pubescens* Willd.

Syn.: *Q. lanuginosa* Thuill.

Tree 20 - 25 m tall, usually lower or often, mainly in the eastern part of its area growing as tall shrubs. Old, single trees (e.g. in France) are characterized by short, thick trunks with a circumference of 5 - 8 m.

A highly polymorphic sub-Mediterranean species separated into several subspecies and a number of varieties and forms. Their taxonomic value is, however, open to doubt although it is generally accepted that three subspecies may be distinguished: subsp. *pubescens* from nearly the whole European part of the area (except the Iberian peninsula), subsp. *palensis* (Palassou) O. Schwarz from the Pyrenees and north-east Spain and subsp. *anatolica* O. Schwarz from the south-eastern part of the Balkans and Anatolia. Sometimes a fourth subspecies is added — subsp. *brachyphylla* (Kotschy) A. Camus occurring in Crete, Greece and the Aegean islands but this is also considered as an independent species — *Quercus brachyphylla* Kotschy.

In Europe the northern limit of the area of *Q. pubescens* runs across northern France, southern Belgium, central East Germany, north Czechoslovakia, north Romania and north Moldaviya SSR. It also grows in south Crimea. In the Caucasus the area of *Q. pubescens* is divided into two main parts: a western — at the Black Sea and an eastern — at the Caspian Sea (Dagestan). The European element continues eastwards into Anatolia (to about 46° E) but there is then no connection with the area of the species in the Caucasus.

Q. pubescens subsp. *anatolica* is characterized by considerable variation in the shape of the lobes and the indumentum and the texture of the leaves. This is probably caused, to a high degree, by introgressive hybridization with *Quercus infectoria* Oliv.; this also occurs with *Quercus petraea* (Mattuschka) Liebl. in Europe. In Anatolia subsp. *anatolica* is chiefly found in the north and west parts of the country and is rather unfrequent in the south. It forms pure forests sparse and low, because of pasturing and felling, or grows mixed with other oaks such as *Quercus cerris* L., *Q. infectoria* Oliv., *Q. macrolepis* Kotschy, *Q. petraea* (Mattuschka) Liebl. (s.l.), and sometimes with *Q. frainetto* Ten. Moreover it is a co-dominant in forests of *Pinus nigra* Arnold subsp. *pallasiana* (D. Don) Holmboe, and grows also in xerothermic scrub of different kinds. Forests of *Q. pubescens*, especially inland, have been much destroyed. Sometimes only single specimens of wild fruit trees (so-called wild orchards) that were constituents of such oak forests, are found among plough-fields and vineyards testifying to their earlier existence. They are: *Crataegus orientalis* Pall., *C. aronia* (L.) Bosc., *C. tanacetifolia* (Lam.) Pers., *Pyrus elaeagnifolia* Pall. and *P. spinosa* Forsk.; they are preserved by man because of the edible fruit.

Q. pubescens belongs to the most xeric oak species in west Anatolia. As a highly photophyllic tree it chiefly grows on very sunny, souther slopes in low mountains and hills. It grows in dry, shallow, skeletal, mainly calcareous soils forming a strong root systems. It is found right from sea level to its highest locality at 1400 - 1500 m a.s.l. (exceptionally higher) but mostly between 300 - 1200 m. In the Crimea, *Q. pubescens* grows as the single specimens to 1000 m, but in the Caucasus (subsp. *pubescens*) it is not found higher than 300 - 400 m.

The wood of *Q. pubescens* is not widely used because of its rather short and often tortuous trunks; it is utilized for fuel.

References: 54 (2), 66, 103 (3), 104 (2), 154, 155, 210, 212, 218 (1), 255.

65. *Quercus trojana* Webb

Syn.: *Q. macedonica* DC.

Tree to 15 - 18 m tall with a trunk diameter to 90 - 110 cm and deciduous or semi-evergreen leaves. In Europe it is met only in south-east Italy (Puglia), in south-west Yugoslavia (south Dalmatia, west Herzegovina, south Montenegro, Macedonia), Albania, north-west Greece, in European Turkey and in south Bulgaria where it is only known in one locality. The species is unknown on the islands of the Aegean Sea and on Crete, but it just reaches Anatolia.

On the Balkan Peninsula *Q. trojana* forms oak forests where it either dominates or is mixed with such trees and shrubs as *Quercus pubescens* Will., *Q. cerris* L., *Q. petraea* (Mattuschka) Liebl., *Carpinus orientalis* Miller, *Fraxinus ornus* L., *Ostrya carpinifolia* Scop., *Cornus mas* L., etc. It is also an important constituent of pseudomaquis, in which it grows with *Juniperus oxycedrus* L., *Quercus coccifera* L., *Phillyrea latifolia* L., *Pistacia terebinthus* L., *Paliurus spina-christi* Miller, *Jasminum fruticans* L., species of *Cistus*, etc.

In Anatolia *Q. trojana* is much rarer than in the Balkans and plays a rather unimportant role. It is limited to the Mediterranean and Sub-Mediterranean territories, and its localities are few and dispersed. It grows both in oak-forests (*Quercus macrolepis* Kotschy, *Q. pubescens* Willd., *Q. infectoria* Oliv. and *Q. cerris* L.) and in light pine woods (*Pinus nigra* Arnold, *P. brutia* Ten.), and even in fir- (*Abies cilicica* (Ant. et Kotschy) Carr.) and cedar-woods (*Cedrus libani* A. Richard), as well as in maquis and pseudomaquis communities. In north-west Anatolia it has been found mainly at lower altitudes (to 900 m a.s.l.), while in the south-west it reaches 1300 - 1600 m.

Q. trojana is closely related to *Q. libani* and the distribution areas of these two oaks touch in the mountains of the Central Taurus. On the Balkan Peninsula, and may be in Anatolia, *Q. trojana* forms hybrids with *Q. cerris* L.

References: 54 (1), 68, 124, 155, 212, 249.

Hamamelidaceae

Liquidambar L.

66. *Liquidambar orientalis* Miller

This is a species closely related to the North American *Liquidambar styraciflua* L. and the two have been considered (sometimes) synonymous.

It is a tree about 20 m tall growing primarily in boggy regions, along streams and river valleys. It occurs singly or forms stands in which it is the dominating species, or it can grow with other trees such as *Platanus orientalis* L., *Alnus orientalis* Decne. and *Ulmus minor* Miller where scrambling climbers particularly *Smilax excelsa* L. and *Vitis sylvestris* Gmel. are frequently found. More rarely *L. orientalis* grows in drier areas such as the slopes of river valleys in *Pinus brutia* Ten. forests. It grows almost from sea level up to about 800 m though usually not above 400 - 500 m.

The range of *L. orientalis* is restricted to southwestern Anatolia (province of Aydin, Mugla, Antalya) and the Greek island of Rodhos. Moreover it is said that *L. orientalis* occurs in the Anatolian province of Hatay (near the border with Syria), by the Asi river not far from the sea shore. The species has also been reported from Cyprus, where, however, it is a long standing introduction known at present in the gardens of two monasteries (Ayios Neophytos and Antiphonitis) in the northern part of the island and in the south near Kolossi Castle. In that region it has found satisfactory conditions and it regenerates naturally. Its bark and wood are used in the churches of Cyprus as incense.

L. orientalis is the source of a valuable balsam — “Liquid storax”, which is obtained by wounding the bark. The production in Turkey of this balsam in 1958 amounted to 24 tons and by 1960 its export to Europe and the USA had reached 62 tons. Among other uses it is employed in medicine.

References: 3, 64 (4), 113, 151 (1), 178, 209, 235, 248.

Parrotia C. A. Mey (monotypic genus)

67. *Parrotia persica* C. A. Mey.

Slow-growing tree, 20 - 25 m high. When 100 years old the diameter of trunk is 25 - 40 cm. The trunk is densely branched, in a very characteristic way, almost from the base with the individual branches often jointed into one, even joining with branches of neighbouring trees. The surface of the trunk is, therefore, irregular with hollows of different kinds and with flat sided fissures.

Until quite lately *Parrotia* has been considered as the only endemic genus of tree for the Hyrcanian Forest region, and the area of *P. persica* seemed to be limited to this Forest only, stretching from the Talish Mts. (USSR) in the west to Gorgan province (Iran) in the east. Lately, however, *P. persica* has been discovered in forests of the south-east confines of the Great Caucasus. The species most closely related to *P. persica* — i.e. *Parrotiopsis jacquemontiana* (Decne.) Rehd., is found only in Afghanistan, Pakistan and in the north-west Himalayas.

P. persica grows mainly on low lying plains and mountain foothills. The optimal conditions for its growth, however, are in stations from 250 - 400 m. Here it forms pure stands (*Parrotietum*) or mixed ones with such species in the main storey of the forest as *Quercus castaneifolia* C. A. Mey., *Carpinus betulus* L., and *Zelkova carpinifolia* (Pall.) C. Koch, and in undergrowth with *Mespilus germanica* L., *Crataegus microphylla* C. Koch, *Ruscus hyrcanus* Woronow and *Buxus hyrcana* Pojark. The number of *P. persica* in the latter forests decreases gradually with increasing altitude, and from 1200 (Talish) — 1400 m (Iran) only solitary specimens of the tree are found.

A thermophilous species, rather shade-loving, needing wet, deep and fertile soils. Though it grows in shallow, skeletal and rather dry soils, too, it does not gain any greater height in these conditions. It avoids marshy or very dry and salted soils. It propagates both from seeds and vegetatively from root off-shoots.

P. persica has remarkably hard, heavy, dense and durable wood and on this account is often named “Iron tree”. Its wood may be used by turners or to make weaving shuttles (Talish) or telephone poles (Iran). Charcoal made of *P. persica* is excellent and highly valued.

References: 6, 103 (4), 104 (3), 201, 206, 207, 239.

Juglandaceae

Pterocarya Kunth.

68. *Pterocarya fraxinifolia* (Poir.) Spach.

Syn.: *P. pterocarpa* (Michx.) Kunth

A quickly growing tree 20 - 30 (35) m high, with a trunk 40 - 80 cm, sometimes even to 1.5 - 2 m in diameter. As it produces suckers from both roots and trunk it is often found in arborescent clumps.

This is the only species of the genus *Pterocarya* which occurs in southwestern Asia. It grows in the Caucasus, in Anatolia and on southern shores of the Caspian Sea in northern Iran and in the Talish Mts. It grows from sea level (or even below in depressions near the Caspian Sea) to usually about 600 - 800 m. The highest stands have been reported from the northern slopes of the Elburz Mts. and from the Great Caucasus, where single individuals of *P. fraxinifolia* have been found at 1200 m.

The species requires considerable humidity of both soil and air. It grows on soils of alluvial origin along water courses sustaining periodic flooding.

Sometimes *P. fraxinifolia* forms pure stands but, much more commonly, it occurs as one of the components of mixed deciduous forests. It grows with such species as *Alnus glutinosa* (L.) Gaertn. subsp. *barbata* (C. A. Mey.) Yaltirik, *A. subcordata* C. A. Mey., *Carpinus betulus* L., *Ulmus scabra* Hudson, *Diosypros lotus* L., *Quercus petraea* (Mattuschka) Liebl. subsp. *iberica* (Stev.) Krassiln., *Q. castaneifolia* C. A. Mey., *Fraxinus excelsior* L., *Acer velutinum* Boiss, *Albizia julibrissin* Durazz., *Populus caspica* Bornm., etc. Characteristically such forests also contain several climbers (e.g. *Smilax*, *Periploca*, *Vitis*, *Clematis*). It occurs also in thickets with *Berberis vulgaris* L., *Crataegus microphylla* C. Koch., *Ficus carica* L., *Vitex agnus-castus* L., *Pyracantha coccinea* Roem., *Buxus colchica* Pojark., *B. hyrcana* Pojark., and *Paliurus spina-christi* Miller.

References: 20, 44, 103 (3), 104 (2), 120, 218 (1).

Leguminosae

Albizia Durazz.

69. *Albizia julibrissin* Durazz.

Small tree growing to 18 - 20 m in height with exceptionally and only in optimal conditions, a trunk diameter of 80 cm.

It has a disjunct distribution, its area being divided into two basic parts — east and west Asiatic, the distance between them amounting to at least 6000 km. The larger part covers south and east China, Korea and Japan. In the west, *A. julibrissin* grows in the Hyrcanian Forest, on the south shores of the Caspian Sea, from the Talish Mts. in Azerbaydzhan, USSR (up to Lenkoran in the north), to the Iranian province of Gorgan. It is also recorded from north-east Anatolia adjoining the Black Sea (Giresun-Trabzon-Rize-Maçka), where it is most probably introduced.

In the Hyrcanian Forest *A. julibrissin* grows to a greater or lesser extent in forests of different types, mostly with such species as *Quercus castaneifolia* C. A. Mey., *Carpinus betulus* L., *Zelkova carpinifolia* (Pall.) C. Koch., *Parrotia persica* C. A. Mey., and *Diospyros lotus* L., and also in riverside terraces with *Pterocarya fraxinifolia* (Poir.) Spach. Here and there on recent landslides in river valleys or in clearings it behaves like a pioneer species. It can be found from the actual sea-shores to 400 - 600 m or exceptionally even higher. Though its soil requirements are slight it grows best in fertile, clayey soils, and in wet alluvial soils, avoiding marshy areas. It is a photophilous species, mesophyllitic, yet tolerating summer drought quite well.

Thanks to its great decorative value — an open umbrella-shaped crown and delicate bright-coloured flowers — the cultivation of *A. julibrissin* is widespread in many countries of Asia and south Europe.

References: 64 (3), 82, 103 (5), 104 (4), 201.

Gleditsia L.

70. *Gleditsia caspica* Desf.

Tree of medium height, 10 - 15 m (exceptionally to 20 m tall) the trunk being 40 - 60 cm in diameter.

A typical representative of the Hyrcanian Forest, stretching on the north side of the main ridge of the Elburz Mts., along the shores of the Caspian Sea, from south Talish in Azerbaydzhan (USSR) in the west

to the Iranian province of Gorgan in the east. It does not occur anywhere else other this area, and then only 20 - 30 km away from the sea-shores. Species most closely related to it, *Gleditsia japonica* Miq. and *G. ferox* Desf., grow only in China and Japan.

G. caspica on the whole, does not form pure stands, though, as mentioned by Grossheim, thick impenetrable groves with a mixture of other species of trees, and a poor brushwood, are known in the region of Astara in Talish (USSR). *G. caspica* grows mostly in the lower storey of trees in broad-leaved forests composed of *Quercus castaneifolia* C. A. Mey., *Carpinus betulus* L., *Parrotia persica* C. A. Mey. and *Diospyros lotus* L., or in damper habitats with *Pterocarya fraxinifolia* (Poir.) Spach, *Alnus glutinosa* (L.) Gaertn. subsp. *barbata* (C. A. Mey.) Yaltirik and *A. subcordata* C. A. Mey. (the so-called *Alnetum hyrcanica*). It also grows as solitary specimens on forest edges and riverside terraces. It occurs more or less from the actual sea-shores up to 1000 m but is most commonly found around 300 - 500 m.

Formerly *G. caspica* was much more extensive than it is at present, but it has been felled to make way for plantations of the tea and rice. This can be observed, for example, near the Caspian Sea in Iran, where solitary specimens can be met among thickets or ridges between rice fields.

G. caspica is a mesophyllic species needing wet soils with a high ground water table (c. 1.5 - 2 m). It grows best on fertile alluvial soils and in marshy places avoiding dry ground. The hard and durable wood of *G. caspica* is used in general carpentering, but for no special purpose. Its sweetish legumes are sometimes used for feeding cattle.

References: 103 (5), 104 (4), 201, 202.

Platanaceae

Platanus L.

71. *Platanus orientalis* L.

A splendid, long-lived tree growing fast to 35 - 40 (50) m with a wide, dense crown. Old, single specimens are characterized by having a short trunk with a diameter of 3 - 5 m (often with hollows). One of the most magnificent trees, recorded from Kos island in the Aegean Sea, is estimated to be over 2000 years old, its trunk being about 18 m in circumference; another is recorded from south Azerbaydzhan, USSR (Karabakh province) - 50 m high, with a trunk 10 m in diameter at ground level.

P. orientalis is considered to be an east-Mediterranean species. In Europe its area is limited to the southern part of the Balkans, Crete, and the Aegean Islands although it may be wild in south-east Italy. Although its distribution in Europe is already well known, in Asia it is not. There is doubt about its status in Middle and Central Asia, where, as is often recorded, it is only cultivated and naturalized and does not occur wild but there are many contrary opinions.

Considering all available information especially about the original planting of plane-tree in Kashmir in the 16th century, it can be assumed that we can trace the history of the species in this part of Asia. It seems that *P. orientalis*, like *Juglans regia* L., *Diospyros lotus* L. or *Celtis caucasia* Willd., i.e. species with which it often occurs, has been, on the one hand, destroyed in natural habitats, and on the other, widely spread in cultivation, as a useful tree giving much shade. It was planted (local materials was probably used) in villages, cemeteries and so-called "sacred" places. These cultivated specimens (which in Kashmir can reach 6 - 8 m in trunk circumference) sowed their seeds in favourable conditions giving rise to new (secondary) populations. This process continues to the present day and occurs also in other countries of south-west Asia (Anatolia) and in the Balkans (Bulgaria). As far as Palestine is concerned the plane-tree has been known since biblical times.

P. orientalis is a hydrophilous tree, very photo- and thermophilic. It tolerates a dry and dusty climate well. It requires fertile, deep, alluvial, alkaline and wet soils, dislikes stagnant water and grows best on river banks along fast-flowing streams such as are found in mountain regions. Here it forms pure narrow strip forests (*Platanetum orientalis*) growing sometimes right at the seashore and seeding freely. Depending on the region it grows together with *Juglans regia* L., *Diospyros lotus* L., *Vitex agnus-castus* L., *Nerium oleander* L., species of *Salix*, *Tamarix* and *Fraxinus* and other mountainous hydrophytes and with *Liquidambar orientalis* Miller in south-west Anatolia.

The plane is distributed throughout Anatolia, except inland areas. It also grows in Cyprus, in north-west Syria, in Lebanon, Palestine, north Iraq and north and west Iran although there are no specific records from there. It is recorded from the Caucasus where it grows in the wild state in the south, in Armeniya – in the river Cav valley and Azerbaydzhan – at the Bassut-čaj river. Here it grows to a height of 36 m with a trunk diameter of about 2 m.

The wild occurrence of *P. orientalis* in the Kopet Dag mountains in Turkmeniya SSR is rather doubtful, then after a long break it is found in Tadzhikistan and in south-east Uzbekistan (the basin of the river Tupalanga and Sangardak). Further eastward it grows in Afghanistan, north Pakistan and in Kashmir, reaching the river Sulej in north-west India (does it grow wild?). Thus its area is similar to the area of *Juglans regia* L., *Diospyros lotus* L., and *Cerasus mahaleb* (L.) Miller.

In Anatolia *P. orientalis* does not grow above 1200 - 1300 m a.s.l. (exceptionally to 1500 m) but in Cyprus it reaches 1350 m, in Afghanistan and Pakistan 1500 - 1600 m, and in Iran (Kerman province) and Kashmir (Ladak region) even to 2500 - 2600 m.

The wood of *P. orientalis* is very decorative in both colour and grain, is easily polished and is therefore used in furniture manufacture, mainly as a veneer. Locally it is applied in houses (door-cases, window-frames) and for varnished and painted articles (cases, boxes).

References: 2, 30, 33, 66, 80, 103 (4), 104 (3), 113, 179, 193, 204, 205, 233, 254.

Rosaceae

Cerasus Miller

72. *Cerasus avium* (L.) Moench

Syn.: *Prunus avium* L.

Tree to 20 m, and in favourable conditions even to 30 m high, with a trunk 30 - 60 cm in diameter.

Species widely spread in nearly the whole of central Europe, partly in southern Europe, and in the Caucasus. It also grows in north-west Africa, Crimea, and northern Turkey, and in north-west Iran. In Mediterranean Europe it is rarely found, at least in the natural states. In the whole region *C. avium* is also grown as a fruit-tree, the first information about this coming from Greece in the 4th century B.C. It is difficult to make an exact delimitation of the area of this species, as, most probably, a number of recorded localities can be accounted for by so-called cultivated varieties having turned wild.

C. avium is a mesphyllic tree, standing shade well. It is found both in broad-leaved and coniferous forests, and grows best in moderately wet and fertile soils, in conditions of high air humidity. Therefore in south-west Asia it is found in forest communities at the Black and Caspian Sea, the communities being formed mainly of beeches, oaks, firs and spruces, and also in river valleys of alder. It grows here from sea level to 1600 m a.s.l. (in the Caucasus even to 2000 m), but it is uncommon, or even very uncommon species.

References: 51, 64 (4), 103 (5), 104 (4), 138.

73. *Cerasus mahaleb* (L.) Miller

Syn.: *Prunus mahaleb* L., *Padus mahaleb* (L.) Borkh., *Padellus mahaleb* (L.) Vass.

Small tree, 6 - 8 m in height, mostly with an irregularly branched trunk, or a high, widely divaricate shrub. Exceptionally it can be larger, a specimen 15 m high with a trunk diameter of 75 cm having been recorded in Middle Asia (USSR).

The area of this species stretches over about 80 longitudinal degrees, from Morocco and Portugal in the west to Kirgiziya and north-west Pakistan in the east. It is common in the whole of the south of Europe, and partly also in Central Europe, reaching as far north as southern Belgium. In south-west Asia it is not known either in Afghanistan or in Israel, and is rare in Syria and Lebanon. In south-east Iran and in south Pakistan, from where it is sometimes mentioned in older floristic works, it is presumably only cultivated and naturalized.

In plant communities *C. mahaleb* is never the dominant plant but occurs as a rule, scattered as single individuals or in small groups, usually on exposed sunny places, on stony, primarily southern slopes of hills and mountains, and also on rocks, in xerothermic thickets, in steppe-forests, and in sparse oak and oak-hornbeam forests, as for example in the Crimea. It occurs most commonly in the valleys of mountain rivers and streams. It is a light demanding, thermophilous species, having few requirements as regards soil — it grows both on limestone and on igneous and metamorphic rocks.

C. mahaleb is characterized by a great altitudinal range. The highest stands in Europe are to be found in Switzerland at 1700 m. In the Crimea this cherry can be met from almost sea level to an altitude of 1000 m. In Anatolia it has been recorded from 300 - 2100 m, and in the mountains of N. Iraq between 1300 - 1800 m. Its highest known locality is in western Iran, in the Bakhtiari mountains, at a height of 3600 m.

C. mahaleb is a species commonly cultivated throughout Europe as an ornamental and is also used in fruit growing as a stock for varieties of sweet and sour cherries. In many places it has become completely naturalized. It is very resistant to drought.

References: 46, 51, 64 (4), 103 (5), 104 (4), 138, 226, 231.

***Crataegus* L.**

74. *Crataegus aronia* (L.) Bosc. ex DC.

Syn.: *C. azarolus* L. var. *aronia* L., *C. azarolus* L. subsp. *aronia* (L.) H. Riedl.

Small, spiny tree up to 8 (10) m high, or erect shrub thickly branched. It is one of the most characteristic species of hawthorns, growing in the west regions of south-west Asia.

Its range extends from Crete, Rodhos and Cyprus through southern Anatolia and north Iraq to the extreme south limits of the Zagros mountains in south-west Iran. It is also known in west Syria, in Lebanon, Israel and Jordan where it reaches the Edom province south of the Dead Sea. Growing from about 100 m a.s.l. up to 2000 m in the Zagros mountains though most frequently between 600 - 1600 m it is only in Iran that it can be found above 1200 - 1400 m. It grows mainly on rocky calcareous soils but it has also been found on sandstone and basalt.

In regions lying along the Mediterranean *C. aronia* is an important component of xerothermic scrubs of different kinds, mainly of *Quercus coccifera* L. In the east of its area in the Zagros Mts., in Iran and Iraq, as well as in the Anti-Taurus mountains in Anatolia it can be met in steppe-forest communities, where *Quercus brantii* Lindl. or *Q. infectoria* Oliv. usually dominate. Solitary specimens of this species are often seen among cultivated fields where it is protected by man because of its edible yellow fruit, much liked by local inhabitants, and even sold in market-places.

C. aronia is very variable species, both in the habit and in the size of its leaves, their indumentum and the depth of incisions between the lobes – it may be that some of its forms resulted from hybridization with other species of hawthorns, mainly with *Crataegus orientalis* Pall.

References: 39, 51, 64 (4), 67.

75. *Crataegus tanacetifolia* (Lam.) Pers.

Small tree, sometimes reaching 8 - 10 m in height, very often, however, just an erect shrub.

The species is endemic to Turkey. It occurs only in northern and central Anatolia, from the province of Eskişehir in the west to Nemrut Dagi at lake Van in the province of Bitlis. It is most often met in the provinces of Bolu, Zonguldak, Kastamonu, Sinop, Çankiri and Amasya. It grows chiefly on rocky, calcareous slopes in open pine and oak forests, but also in mixed forests, at an altitude from 750 - 1800 m a.s.l., although usually between 1000 - 1300 m. It sometimes forms hybrids with *Crataegus orientalis* Pallas and *C. monogyna* Jacq.

References: 47, 64 (4), 67.

***Eriolobus* (Ser.) Roemer (monotypic genus)**

76. *Eriolobus trilobatus* (Poir.) Roemer

Syn.: *Crataegus trilobata* Poir., *Pyrus trilobata* (Poir.) DC., *Sorbus trilobatus* (Poir.) Heynhold, *Malus trilobata* (Poir.) C.K. Schneid.

An East-Mediterranean species, the only representative of the genus *Eriolobus* which is often included in *Sorbus* or *Malus* by different authors.

Tree 4 - 6 m high (even to 10 m when cultivated), with very distinctive leaves, their shape being similar to those of *Sorbus torminalis* (L.) Crantz. The range of *E. trilobatus* is broken into several disjunct areas and stretches from Thrace in Greece and Bulgaria, over west and south Anatolia, Lebanon and north Israel; it does not occur in Syria. Nearly everywhere it is a rare, or even very rare, species, represented only by single specimens; it is most frequent in south Anatolia in the Maraş region and in the Amanus Mts., and in Lebanon. It is found at altitudes from 50 m in Greece to 1800 m in Lebanon.

In Thrace *E. trilobatus* is a constituent of Mediterranean scrubs (*Quercus-Cistus* scrub), while in Lebanon in associations of *Quercus coccifera* L. and *Pistacia palaestina* Boiss. In Turkey it is sometimes met in pine forests, as well as in scrubs at field edges. It usually grows in sunny places on rock, limestone or chalk soils.

References: 35, 43, 64(4), 163(2), 254.

***Mespilus* L. (monotypic genus)**

77. *Mespilus germanica* L.

Small tree, to 6 m high, the diameter of the trunk to 20 cm or often growing as a strong, erect shrub.

It is a typical Euxino-Hyrcanian species, limited in its occurrence mainly to regions situated along the Black and Caspian Seas and to the Caucasus. It stretches from Sakar Planina in south-east Bulgaria, eastwards

to Turkmeniya (USSR) where it is found in the mountains of Kopet Dag, in the Gjuen gorge and on the river Čandyr. In this latter locality, however, at 650 m a.s.l., it is very rare, represented by only a very few specimens.

M. germanica grows in different kinds of open broad-leaved forests, mainly oak-, and oak and hornbeam-, and beech, but also in forests mixed with pine, firs, and even spruce. Though it tolerates shade quite well, it prefers places with more light and is found in scrubs and forest edges, and in communities of maquis type. It needs fertile and wet soils and rainfall up to at least 500 - 600 mm.

In Turkey it grows right from sea level to more or less 1300 m though near Maraş in an isolated locality in the southern part of the country it is found at 1650 m. In the Caucasus it grows higher up, to 1800 m, and in Iran, in the Elburz Mts. to even over 2000 m. In Iran it is found at its lowest level where in the Caspian region it is found at 15 m below sea level. In the only locality in the mountains of north-east Iraq *M. germanica* reaches its highest station — 3150 m a.s.l.; it was found there in a subalpine thorny-cushion community. The species is also mentioned from Cyprus, where it has probably been introduced for cultivation near monasteries, and later has grown wild.

A strict delimitation of *M. germanica* in Europe is rather difficult. It has been known since the 7th century B.C. and since ancient times has been cultivated because of its tasty fruit (cultivated forms have fruit 5 - 8 cm in diameter, while wild ones 1.5 - 2 cm). In South and Central Europe it has been planted for a very long time and it has naturalized in many places, so that it appears wild. It is not unlikely that some localities of *M. germanica* (not indicated in the map) in Greece, especially those which are situated near the Bulgarian and Turkish borders (Thrace) should be accepted as natural ones but this is not clear and it is a matter of controversy.

References: 34, 51, 64(4), 83, 103(5), 104(4), 228(2).

Pyrus L.

78. *Pyrus boissieriana* Buhse

This is either a tree of about 6 m, or a shrub. It occurs scattered as single individuals, or in small groups formed vegetatively from root suckering.

The range extends in a narrow belt along the shores of the Caspian Sea, from the Talish Mts. in the west through northern Iran to the western tip of the Kopet Dag Mts. in the Kara-Kala region (Turkmeniya). The major part of the range is in Iran, where it appears that the species is not evenly distributed. It is recorded primarily from the provinces of Gilan, Mazandaran and Gorgan. It occurs at altitudes from 600 to 2400 m in Iran and from 600 to 1500 m in Turkmeniya. It is usually to be found in mixed forest with oaks (*Quercus castaneifolia* C. A. Mey., *Q. macranthera* Fisch. et C. A. Mey., *Quercus petraea* (Mattuschka) Liebl. subsp. *iberica* (Stev.) Krassiln.) and such trees as *Acer cappadocicum* Gled., *A. campestre* L., *A. velutinum* Boiss., *Fraxinus excelsior* L., *Sorbus torminalis* (L.) Crantz and *Mespilus germanica* L. In northern Iran it occurs also in cypress forests (*Cupressus sempervirens* L.) and in forests of *Platycladus orientalis* (L.) Franco.

In southwestern Asia *P. boissieriana* is the only representative of the pears from section *Pashia* Koehne. This section is characterized by fruit lacking a calyx and covered with small white lenticels. It is represented primarily by species growing in East Asia, particularly in China, the species most closely related to *P. boissieriana* (*P. pashia* D. Don) growing as far west as Nuristan in eastern Afghanistan.

References: 40, 51, 103(5), 104(4), 230.

79. *Pyrus elaeagnifolia* Pallas

A small tree, usually only 10 - 12 m high, to 50 cm in diameter often growing as a high erect bush.

A forest-steppe species, widely distributed over the whole of Anatolia, in south Crimea, in Black Sea regions of Romania (Dobruja), in Bulgaria and European Turkey. In the three latter regions it is represented by a separate subspecies — subsp. *bulgarica* (Kuthath. et Sachok.) Valev. *P. elaeagnifolia* (subsp. *elaeagnifolia*)

is often recorded from the Balkan Peninsula and elsewhere, but judging from available material it appears that the data refer to semi-wild, cultivated forms of a pear-tree of unknown origin, may be of *Pyrus nivalis* Jacq. or of the hybrids of *Pyrus communis* L. and *P. elaeagnifolia* (= *P. × armud* Hausskn. et Bornm.) brought most probably by the Turks in the 17th and 18th centuries. In the Caucasus *P. elaeagnifolia* is replaced by a closely related species – *Pyrus georgica* Kuthath.

It is a light demanding species, resistant to dryness and frost. It usually grows in stony soils, in open deciduous forests, and in degraded forests, but also in remnants of oak forests (*Quercus cerris* L., *Q. pubescens* Willd., *Q. infectoria* Oliv.) among cultivated fields and on their edges where sometimes it is the only tree to be seen in the landscape.

P. elaeagnifolia is one of the most common pears in Anatolia where it is usually found between 1000 - 1700 m a.s.l. Localities lying lower are probably secondary – the pear appeared there after forests had been destroyed. The highest localities are situated in Anatolia 2000 m a.s.l. In the Crimea they are mainly between 700 - 1100 m. In both those regions *P. elaeagnifolia* is grown as a fruit-tree.

References: 64(4), 67, 138, 139, 215.

80. *Pyrus korshinskyi* Litw.

Syn.: *P. bucharica* Litw.

This is a tree attaining a height of 5 - 15 m and a stem diameter of 120 cm although sometimes it is a tall shrub.

The major part of the species range covers the mountains of western Tyan Shan and Pamir-Alai in the USSR (southwestern and central Tadzhikistan, southeastern Uzbekistan and southern Kirgiziya). In addition a few scattered stands are known from northern Afghanistan. It is found from 1000 to 2000 m, although it grows best between 1400 and 1800 m where it is most abundant propagating easily and forming small woods. Most commonly, it grows as a single tree or in small groups, on fine grained, clay or gravelly-clay slopes together with such xerophytic trees and shrubs as *Juniperus seravschanica* Komarov, *Celtis caucasia* Willd., *Crataegus pontica* C. Koch, *C. turkestanica* Pojark., *Acer pentapomicum* J. L. Stewart, *Malus siversii* (Ledeb.) Roem., *Rosa kokanica* Rgl., *Lonicera korolkovii* Stapf, *L. nummulariifolia* Jaub. et Spach, *Cotoneaster hissarica* Pojark., *Amygdalus bucharica* Korsh. etc.

In Middle Asia *P. korshinskyi* is also planted in gardens as a fruit tree. It is very resistant to drought and insect or fungal injury, and for this reason may prove useful in pomological breeding work or as a root stock. The inhabitants of Tadzhikistan have been using this plant pomologically by grafting cultural varieties on to stock growing in the natural conditions. In this way very characteristic „forest-orchards” have been formed, frequently covering considerable areas.

P. korshinskyi is a very variable species particularly as regards pubescence and leaf form. On seedlings, on suckers and on strongly growing long-shoots the leaves are incised with deep usually narrow lobes, remotely serrate along the margins, while on short-shoots they are entire, elongate ovate or elongate lanceolate. *Pyrus bucharica* Litw. included by Rehder in *P. korshinskyi* is sometimes considered as a hybrid between this species and *Pyrus regelii* Rehd. which has pinnatifid leaves both on long- and short-shoots.

References: 51, 177(4), 230, 252.

81. *Pyrus salicifolia* Pallas

A small tree about 8 - 10 m high, often growing as a straight and strongly spiny bush.

An East-Caucasian species, widely spread over the Soviet States of Azerbaydzhan and Armeniya, and over Dagestan and east Georgia, as well. It also spreads, though not so richly, in north-east and east Anatolia, and in Iranian Azerbaydzhan. It grows in dry, and even very dry regions, where the amount of annual rainfall

ranges from 200 to 600 mm. It occurs in steppe-forest, steppe and even semidesert communities where, however, it does not reach any considerable size.

P. salicifolia is mentioned as growing in low, sun-soaked oak-, juniper- and pistachio-groves, as well as in xerophytic thickets where *Paliurus spina-christi* Miller and *Rhamnus pallasii* Fisch. et C. A. Mey. dominate; sometimes it forms pure thickets. It grows on gravelly and stony slopes, and on rock substratum, in warm and sunny places — in the Caucasus between 300 - 1800 m, and in Anatolia even up to 1900 m. It propagates itself by seeds and root off-shoots.

The small but sweet fruits of this pear are much liked by local people, and sometimes are even sold in bazaars. *P. salicifolia* is therefore protected from felling and very often one can see it among cultivated fields or along their edges.

References: 51, 64 (4), 67, 103 (5), 104 (4), 230.

82. *Pyrus spinosa* Forssk.

Syn.: *P. amygdaliformis* Vill.

Small, strongly spiny tree to 6 m tall, often in the form of a shrub. A typical Mediterranean species, whose range is, however, limited to the northern shores of the Mediterranean Sea.

It grows in Spain, France, Italy, Yugoslavia, Albania, Greece, Bulgaria and in Turkey-in-Europe as well. It is also known on the Aegean Islands, Rodhos, Crete, Sicilia, Sardinia and Corsica but is absent in north Africa. It is probably more common in the eastern than in the western part of the Mediterranean area. It grows chiefly on dry, stony and gravelly slopes, and on rocks, especially calcareous ones, stretching practically from the sea shore itself up to 1000 m. Inland, in Anatolia, it reaches 1500 m.

P. spinosa is a characteristic constituent of xerothermic thickets of shiblyak (deciduous bush formation), pseudomaquis and maquis type, besides which it occurs in degraded oak forests (*Quercus pubescens* Willd., *Q. cerris* L., *Q. macrolepis* Kotschy) and in light pine-woods (*Pinus brutia* Ten., *P. nigra* Arnold).

The natives of Anatolia protect the species against felling; sometimes single trees of *P. spinosa* may be seen among cultivated fields. Cultivated (pomological) forms of *Pyrus communis* L. are grafted on to it sometimes even on to old specimens. Some branches (especially the bottom ones) of such grafted trees, when neglected and growing in a wild state are referable to *P. spinosa*, and some to cultivated forms.

P. spinosa forms hybrids with *P. communis* L. and probably with *P. elaeagnifolia* Pallas, too.

References: 64 (4), 67, 79.

83. *Pyrus syriaca* Boiss. (incl. *P. glabra* Boiss.)

Small tree, usually 5 - 8 m high, although in the very favourable conditions it can grow higher, as for instance in south Transcaucasus where it attains 14 m high, with a trunk 40 cm in diameter.

It is found in numerous localities in Anatolia (especially in the south and east), on Cyprus, in west Syria, Lebanon and in north Israel and west Jordan, in the mountainous, north-east part of Iraq, in west Iran and in the USSR — south Armeniya and Nakhitschevan ASSR. The most southerly localities are in the Judean Mts. near Jerusalem, and in Fars province of Iran.

P. syriaca is a photophilous species. It grows in open places, in thickets or in loose, sunny oak-groves and at their edges, on rocky or stony, calcareous slopes from 300 m (Anatolia) up to 1800 m, and in some places even up to 2300 m (Iran). In the higher altitudes it is chiefly found along riverbanks. In the northern part of its range it sometimes forms hybrids with *P. salicifolia* Pallas.

A considerably variable species both in the shape of leaf blade and in the length of petiole and pedicels. In south-west Iran the range of *P. syriaca* borders on the range of another pear, *P. glabra* Boiss., which is

closely related to it. The latter is characterized by elongate-lanceolate, entire or nearly entire leaves. As in the mountains of west Iran (Zagros Mts.) intermediate forms are met, it seems that the taxa could be considered as two subspecies within *P. syriaca* sensu lat. They have been treated in this way in this work.

References: 38, 51, 64 (4), 67, 103 (5), 104 (4), 151 (1), 228 (2), 230.

Sorbus L.

84. *Sorbus aucuparia* L.

Syn.: *S. boissieri* C. K. Schneider, *S. caucasigena* Komarov

A small tree, 10 - 15 m, exceptionally 20 m high, the trunk to 40 cm in diameter; on dry and poor soils, in forest undergrowth and in high mountains it often grows as a shrub.

A Euro-Siberian species. With the exception of the south and central Iberian Peninsula and southern Ukraine, it is common in Europe, on the Caucasus, and in Siberia where it is represented by subsp. *sibirica* (Hedl.) Krylov. In the north, in Scandinavia it grows beyond 70° N.

S. aucuparia is distinguished by a wide ecological scale and occurs in all types of forests, both deciduous and coniferous. It grows mostly in rather dry, acid, clay and clay-sandy soils, but it can be also found in dry, sand soils, in wet meadows and peatbogs, as well as on rocks. Though a light requiring species it tolerates shade quite well.

In the north and central part of its area *S. aucuparia* spreads in lowland, but in mountains it reaches the upper forest limit and encroaches upon the sup-Alpine storey. The more southerly the rarer and more dispersed are its localities, usually limited to places above 700 - 1000 m a.s.l.

The area of *S. aucuparia* in south-west Asia is more or less distinctly isolated from the European part, connected only where it occurs in the Caucasus. In Anatolia it is mostly found in coniferous, mainly pine forests, and its localities are concentrated in the north. The only locality in central Anatolia is in the mountain massif of Erciyas Dagi, south of Kayseri where it reaches its maximum altitude — 2800 m a.s.l. It is very rare in northern Iran where it has only been found in Qareh Dag mountain (province of Azerbaydzhan) and in the Elburz massif (province of Mazandaran) between 1900 - 2500 m a.s.l.

References: 51, 67, 79, 92, 93, 94, 103 (5), 104 (4), 126, 138.

85. *Sorbus domestica* L.

Tree 10 - 15 m high, 70 - 80 cm in diameter, though old specimens can reach 20 m tall and 130 cm in diameter.

The species covers nearly the whole of south, and partly central Europe. Northwards it reaches central East Germany (Wernigerode, Halberstadt), but it never exceeding 52°N. The eastern limit of *S. domestica* is in Moldaviya, on the Crimea and in Anatolia (to 40°E). Its south-west limit is the Algerian mountains, where it is very rare, only known from a few localities.

S. domestica requires warmth and is resistant against drought. It is mainly found singly in light deciduous forests chiefly oak (*Quercus pubescens* Willd.) or in oak-hornbeam or oak-beech. It grows on warm, sunny slopes, on hillocks and on mountain foothills, usually not higher than 600 m a.s.l. Its highest localities are on the Crimea at 800 m, in Bulgaria and Turkey at 1000 m, and in Greece on the Athos mountain at 1350 m. There are no precise data about its localities in Jugoslavia where it is rather frequent so its distribution there remains somewhat in doubt.

In Anatolia *S. domestica* is a rare species mainly restricted to the north-west where its localities are much dispersed. Very far from these localities it is found again in south Anatolia, in the Amanus Mts.

It is rather difficult to define precisely the limits of the area of *S. domestica*, as it has been cultivated for ages and most probably has run wild in some places. Its large fruit, one of the biggest in the genus *Sorbus*, to 3, and even 4 cm long, is eaten fresh or is used in different kinds of food (jam, alcoholic drink, compote). The fruit is very variable, both in size and shape (for instance var. *maliformis* Pénzes, var. *pyriformis* Pénzes), the large-sized fruit coming from cultivated trees.

References: 64 (4), 67, 79, 93, 94, 126, 138, 151 (1).

86. *Sorbus torminalis* (L.) Crantz

Syn.: *S. orientalis* Schönbeck-Temesy

The tallest species among the European representatives of the genus *Sorbus* grows up to 25 m and has a trunk 75 cm in diameter. Its area covers south, west and central Europe, north-west Africa, the Caucasus and the western part of south-west Asia. Northwards it reaches the central part of Great Britain, southern Denmark and north Poland.

S. torminalis grows both in lowlands (especially in the north) and in mountains, its highest localities being in the Crimea – to 1200 m a.s.l., Lebanon – to 1250 m, Syria – to 1400 m, Greece – to 1600 m, the Caucasus – to 1900 m, and Turkey and Iran – to 2200 m. It grows in mixed deciduous, mainly oak, hornbeam, beech and chestnut forests and in thickets of shrubs on sunny places. It usually grows singly in the second forest storey, rarely forming small groups. When young it tolerates moderate shade, when older it needs much light. A warmth-requiring species, resistant to drought; it grows best in deep fertile soils mixed with calcium. It has root-suckers.

In south-west Asia the southern limit of its area, *S. torminalis* is most common in Anatolia, especially in its northern part. It is also found in the Ansariye mountains in west Syria and in the mountains of north and central Lebanon. In Iran its area is strictly limited to the pre-Caspian mountain belt, though it is a rare species there. To the east it is found in the north-west border of Khurasan province (National Park situated east of Gorgan) up to 56° E where it is characterized by its rather short leaf-lobes. It was given the name of *Sorbus orientalis* Schönbeck-Temesy. Considering, however, the exceptional variability of the leaves of *S. torminalis* throughout its whole area such a view is rather groundless.

The wood of *S. torminalis* is heavy, fine grained, hard but elastic, easy to polish and nicely coloured, suitable for furniture and for turning.

References: 41, 51, 64 (4), 67, 79, 92, 93, 94, 103 (5), 104 (4), 126, 138.

Salicaceae

Populus L.

87. *Populus caspica* Bornm.

Syn. *P. hyrcana* Grossh.

Tall or medium tall tree with a wide crown which grows in forests of north Iran, adjacent to the Caspian Sea in the provinces of Gilan, Mazandaran and Gorgan. It grows in alder woods, and mixed broad-leaved forests, composed of such species as *Alnus subcordata* C. A. Mey., *A. glutinosa* (L. Gaertn.) subsp. *barbata* (C. A. Mey.) Yaltirik, *Fraxinus excelsior* L., *Pterocarya fraxinifolia* (Lam.) Spach, *Diospyros lotus* L., *Albizzia julibrissin* Durazz., *Gleditsia caspica* Desf. etc. It is distributed in lowlands and probably does not reach any higher than 500 - 600 m a.s.l. Besides Iran it is also known in the Hyrcanian Forest of the Talish Mts. (USSR, province of Lenkoran), where it is known under the name *Populus hyrcana* Grossh.

P. caspica is sometimes identified with *Populus bachofenii* Wierzb., found in the mountains of Uzbekistan and Tadzhikistan as well as in Afghanistan and Pakistan. These two species apart from some morphological characteristics, differ in ecological requirements. *P. caspica* is a lowland species growing on fertile and wet soil, while *P. bachofenii* Wierzb. covers mountain slopes to 2500 m.

Both *P. caspica* and *P. bachofeni* Wierzb. are closely related to the European *Populus alba* L., and should probably be treated as only subspecies. The taxonomy of this group of poplars is very complicated indeed, and the opinions of various authors on the nomenclature of the different taxa, distinguishing morphological characteristics and geographical distribution, are very divergent. In addition there is still the problem of cultivated forms characterized by different structures of the crown (so-called pyramidal forms) the origins of which are not yet sufficiently explained.

References: 103 (3), 104 (2), 174.

88. *Populus euphratica* Oliv.

Syn.: *P. diversifolia* Schrenk, *P. ariana* Dode, *P. litwinowiana* Dode, *P. transcaucasica* Jarm.

Tree of medium size, reaching 15 - 18 m in height, with a trunk of about 80 - 90 cm in diameter. This poplar is remarkable for the extreme variability of the leaf shape and size. On young individuals, mainly on long shoots and suckers, the leaves may be linear, lanceolate or ovate-elongate with entire margins, while on older trees, on short shoots, they are roundish, broad-ovate, even reniform, with several distinct teeth in the upper part. The number and shape of these teeth have been the reasons for distinguishing a number of separate, independent, yet critical taxa here included in synonymy.

P. euphratica has, without doubt, one of the most interesting distribution of arborescent plants in south-west Asia. It extends from the west over at least 115° of latitude degrees – from Morocco to the Ordos Plateau in China. The most northern localities are found in Kazakhstan at about 48° - 49° N, while the southernmost are in south Pakistan (near Karachi), at about 25° N. and on the Arabian Peninsula (Ardah Hills). No less interesting is the altitudinal range of *P. euphratica*. The lowest stands can be found in the depression of the Dead Sea, around – 390°, while, the highest have been found in Kashmir at an altitude of 4000 - 4500 m. In Iraq they reach 1100 m, in Turkey and in Afghanistan 1650, and in Iran 1800 m.

Besides south-west Asia, *P. euphratica* occurs in north Africa – Morocco, Algeria, Egypt (very seldom here), in the Caucasus, in the republics of Middle Asia – Turkmeniya, Uzbekistan, Kirgiziya, Tadzhikistan, Kazakhstan, and in west and north China, as well as in south-west Mongolia. The stands of *P. euphratica*, though numerous are widely dispersed and often remote from one another. As a rule they are situated on river and stream banks, where the trees form small clumps or larger forest communities, so-called “tugaj” – pure or mixed with such species of trees and shrubs as *Populus pruinosa* Schrenk, *Elaeagnus angustifolia* L. and *Halimodendron halodendron* (Pall.) Voss, and with different species of *Tamarix* and *Salix*, etc. This kind of forest is often greatly devastated because of the development of agriculture in the river valleys, and the felling of trees for fuel. In spite of this they have so far been preserved in some places in quite a good state. For instance, in China, in the north-western Alashan desert on the Joshui river millions of trees of *P. euphratica* can be found; they form a narrow belt of river-side forests, 1 - 3 km wide. In places where *P. euphratica* grows together with *Populus pruinosa* Schrenk hybrids occur often given the name – *Populus* × *glaucicomans* Dode.

P. euphratica propagates easily vegetatively thanks to off-shoots from the trunk and roots. Because of this feature, in places where this tree has been felled, there is quick regeneration and compact off-shoots scrubs are found – these are usually unisexual population (dioecious species).

The wood of *P. euphratica* has no special value, yet in timberless regions, in dry and hot areas of south-west and central Asia, this poplar is important economically – the wood is used as fuel, leaves and young shoots as fodder for goats and camels, while the bark is applied in folk medicine.

References: 30, 45, 103 (3), 104 (2), 174, 177 (3), 218 (1), 229, 254.

89. *Populus pruinosa* Schrenk

Tree up to 20 - 25 m high, trunk with a diameter to 150 cm, though usually not exceeding 80 - 90 cm.

This is a second species of poplar from section *Turanga* its area, however, being much smaller than the other member, *Populus euphratica* Oliv. It is limited to the middle Asiatic Republic of USSR and to south Kazakhstan, west China (Kuldja, Kucha, Kashgar, Yarkand, Khotan) as well as to north Afghanistan where judging by its occurrence in Turkemiya, Uzbekistan and Tadzhikistan, it is probably more frequent than the available information implies.

P. pruinosa grows in regions with a dry and hot climate, in sandy, sometimes saline, soils, on lowlands and plateau. It is much rarer in mountain areas, where it reaches 1950 m in Tadzhikistan (in Afghanistan it is known at a height of 1670 m). It spreads exclusively along various watercourses, especially in valleys of larger rivers or along their tributaries. In the west it is found along such rivers as the Tedzhen, Murgab, Amu-Darya-Pyandzh, Syr-Darya, Chu and Ili. In the north it reaches the delta of the Amu-Darya (Kara-Kalpaksкая ASSR), along the Syr-Darya (more or less) up to the town Dzhusaly and up to lake Balkhash.

In its biological and ecological properties *P. pruinosa* is very similar to *P. euphratica* Oliv. and forms analogous communities.

References: 174, 177 (3), 218 (1), 229.

90. *Populus tremula* L.

Tree to 20 - 25 m tall, sometimes taller, the trunk diameter to 1 m, freely suckering.

A Euro-Asiatic species, widely distributed in nearly the whole of Europe (in Scandinavia to about 71° N), in west and east Siberia, in north-east Asia (Far East, Manchuria and Korea) as well as in China and Mongolia and in south-east Kazakhstan; in isolated localities it grows in north-west Africa in the Babor and Tababor mountains.

In the north and central part of its area in lowland *P. tremula* often forms pure stands or is mixed in forests with different kind of deciduous and coniferous trees. The more southwards the more frequently (or exclusively) it grows in mountains. A pioneer species, photophyllic, mesophyllic, growing quickly, without any special soil requirements, yet developing best in wet, humus, clayey-sandy soils, mixed well with limestone.

In south-west Asia *P. tremula* is found in Anatolia, in the Caucasus and central Lebanon. In Lebanon it is only known from three localities, closely situated, at the height of about 1000 m. In Anatolia it is the commonest member of the genus in the whole country, with the exception of the driest central and south-east regions, bordering with Syria (so-called Mesopotamia). At the Black Sea it is found on forest edges and in scrub from the sea-level; and inside the country it grows high in the mountains, being a constituent of mountain and subalpine forests. Sometimes it forms its own pure communities marking the upper forest limit. The highest localities are on Erciyas Dagi, south of Kayseri - 2500 m, on Bingöl Daglari - 2400 m, and on Nemrut Dag at Lake Van - 2300 m. In the Caucasus, where *P. tremula* is much more common than in Anatolia the localities are at the height of 2200 (2500) m.

The wood of *P. tremula* is soft, light and easily splintered, white-coloured, valuable in the cellulose and match-making industry. Locally it is utilized in making house utensils and as fuel.

References: 19, 103 (3), 104 (2), 141, 218 (1).

Tiliaceae

Tilia L.

91. *Tilia caucasica* Rupr.

Syn.: *T. rubra* DC. subsp. *caucasica* (Rupr.) V. Engl., *T. platyphyllos* Scop. subsp. *caucasica* (Rupr.) Loria, *T. dasystyla* Stev., *T. multiflora* Ldb.

Tree to 30 - 35 m tall, with a diameter 1.5 - 2 m (and more). A Caucasian species, widely distributed in the belt of the Great and Lesser Caucasus (chiefly in the western part) and also in the Talish mountains. In addition it grows in south Crimea, in the Hyrcanian Forest of north Iran, and in a few scattered localities in north Anatolia. Here isolated localities are found in the Aegean region, on Kaz Dag and on Samsun Dag.

T. caucasica is a typical, mesophyllic, rather shade-seeking forest tree growing singly in beech- (*Fagus orientalis* Lipsky) and oak-forests. In Talish and Iran it grows also in alder forests (*Alnus subcordata* C. A. Mey.) with *Acer cappadocicum* Gled., *Diospyros lotus* L. and *Albizzia julibrissin* Durazz. This lime is very common in some places in the Caucasus, especially, in damp and shady valleys. Here besides beeches and oaks *T. caucasica* grows with *Fraxinus excelsior* L., *Ulmus glabra* Hudson and *U. minor* Miller, *Pyrus communis* L. subsp. *caucasica* (Fed.) Browicz, *Mespilus germanica* L., *Crataegus pentagyna* Waldst. et Kit., etc. In north Anatolia the Caucasian lime is recorded from mixed deciduous and coniferous forests (*Abies nordmanniana* (Stev.) Spach — *Picea orientalis* (L.) Link) between 300 - 1500 m a.s.l. In Iran it grows between 100 - 1600 m, only exceptionally above 2000 m (up to 2400 m); in the Caucasus (Armeniya) to 2200 m.

The wood of *T. caucasica* like the wood of other lime species, is light, soft and splintery, rather undurable, easy to work, so it is utilized in wood-carving, and to make small household objects. A honey-yielding and medicinal plant.

The taxonomic position of *T. caucasica* is not yet well known, and its relation ship to other closely related (small species) needs investigation. *T. caucasica* forms hybrids with *Tilia cordata* Miller in the Caucasus.

References: 64 (2), 103 (6), 104 (2), 147.

92. *Tilia tomentosa* Moench

Syn.: *T. argentea* DC.

Tree to 30 m high, with a characteristic, wide cone-shaped crown and leaves white tomentose below.

A Balkan species, the area of which is very similar to that of *Quercus frainetto* Ten. It is found in nearly the whole of the Balkan Peninsula, yet in Greece it is rather rare and its localities there are scattered — found more often in the north; in Bulgaria it is the most common lime. Its northern limit runs through north Hungary and south-west Ukraine and Moldavia. It also grows in Anatolia, in the north and in the south.

The larger area covers north-west Anatolia along the Black Sea reaching east to Karabük in the province of Zonguldak. It is also found in a few, rather isolated localities in the provinces of Balıkesir, İzmir and Uşak. In the south it is limited to the Amanus mountains, mainly at the northern end. The distance between the nearest localities of these two regions is about 600 km — between Murat Dagı and Dörtöl in the Amanus Mts.

As in Europe *T. tomentosa* is found in Anatolia singly in oak-, oak-hornbeam-, and beech-forests, mainly in river valleys. It grows right from the sea-shore up to 700 (1000) m, but only between 750 - 1500 m in the Amanus mountains. In Yugoslavia and Romania the highest localities are at 1200 m, and in Albania and Bulgaria — 1300 m.

T. tomentosa is a thermophyllic, mesophyllic tree, sensitive to dry air. It grows best in fertile, wet, light, slightly acid soils. It tolerates shade well.

A decorative species, often planted along streets.

References: 64 (2), 99.

Ulmaceae

Celtis L.

93. *Celtis australis* L.

Tree 20 - 25 m high with a trunk to about 3 m in circumference. *C. australis* is found in southern Europe, the coastal regions of north Africa and south-west Asia where it reaches its eastern limit.

In Turkey *C. australis* grows along the shores of the Aegan, Mediterranean and Black Seas. It is not found in central Anatolia. In the Caucasus only a few localities are recorded from west Gruzija. After a considerable disjunction it occurs in the Talish mountains and north Iran but not going beyond the Hyrcanian Province. Eastwards it grows as far as Herat in west Afghanistan, where, however, it seems unlikely, that it is native. The records of *C. australis* occurring in the Hindukush and in the Himalayas should be verified – it may well be that refer to *Celtis caucasica* Willd.

A species often cultivated and naturalized in some places. All localities of *C. australis* in Syria, Lebanon, Israel and Cyprus are considered to be anthropogenic.

In south-west Asia *C. australis* is found only sporadically. It usually grows single on stony slopes, in ravines, in river and stream valleys, in open places or in deciduous forests, with *Fagus orientalis* Lipsky, *Carpinus betulus* L., *Ulmus glabra* Hudson, etc. As far as it is known it never grows above 1000 m a.s.l.

The wood is used in furniture manufacturing and to make household objects but being so scarce *C. australis* has no great economic value.

References: 78, 103 (3), 104 (2), 141, 218 (1), 221, 253, 254.

94. *Celtis caucasica* Willd.

Tree to (12) 15 m high, quite often a shrub; when cultivated it can grow up to 20 or more meters.

The area of *C. caucasica* covers central and south-west Asia. From Kashmir and the south-eastern regions of Kazakhstan in the east it runs through Tadzhikistan, south-east Uzbekistan, north Afghanistan, south Turkmeniya, to Turkey in the west where it reaches Safranbolu in province of Zonguldak. Information on its occurrence in Europe are erroneous and refers to another species (*C. glabrata* Stev.)

Within its extensive area *C. caucasica* occurs very irregularly. It is common in the Caucasus, in Tadzhikistan and north-west Afghanistan; in the other regions it is rather rare. It grows from sea-level to about 2500 m, and is at its highest in north-east Afghanistan in the river basin of the upper course of the river Panjashir.

C. caucasica grows in various soils and varied plant communities, either semidesert or steppe or forest. It can be usually found in open places, on mild mountain slopes, in ravines etc., among steppe vegetation, quite often in light deciduous forests. In the Caucasus it sometimes grows in open forest with *Quercus petraea* (Mattuschka) Liebl. subsp. *iberica* (Stev.) Krassiln., *Carpinus orientalis* Miller, *Pistacia atlantica* Desf. subsp. *mutica* (Fisch. et C. A. Mey.) Rech. f. In the east regions of its area in Afghanistan it is a frequent constituent of light deciduous forests formed by thermophyllic species as *Quercus baloot* Griff., *Olea ferruginea* Royle, *Acer pentapomicum* J. L. Stewart, etc.

Being resistant to both drought and torrid heat it is utilized as a street tree, especially in central Asia. In addition it is grown to help fix eroded mountain slopes. The wood is used in the manufacture of furniture and to make household objects. Baskets are made of the twigs. The fruit is turned into meal which is mixed with flour to make bread. Oil is extracted from the seeds.

References: 102, 103 (3), 104 (2), 141, 218 (1), 252, 253.

95. *Celtis glabrata* Stev.

Syn.: *C. tournefortii* Lam. var. *glabrata* (Stev.) Boiss.

A shrub or small tree 2 - 6 (12) m high. The species is limited to south-west Asia and south-east Europe. In Asia, where it prevails, *C. glabrata* occurs in the Caucasus, in Anatolia, north Iraq, west Syria and west Iran. In Europe it grows only in the Crimea, Crete and the Balkans (west Bulgaria, Yugoslavian Macedonia, east Greece). It is found from sea-level to 2500 m, its highest locality being in Iranian Azerbaydzhan near Mianeh.

Compared with *Celtis caucasica* Willd. it is more resistant to drought and more thermophyllic. It grows mostly in open places, on mild mountain and ravine slopes, usually in steppe communities, rarely in light oak groves or at their edges. It has no economical value due to its small size and sparse distribution.

References: 49, 103 (3), 104 (2), 218 (1), 253.

96. *Celtis tournefortii* Lam.

A shrub or small tree to 3 - 8 (12) m high. The species is closely related to *Celtis glabrata* Stev. and is sometimes discussed in conjunction with it.

As with *C. glabrata* Stev., the area of *C. tournefortii* covers south-west Asia and the south-east regions of Europe. The species, however, does not grow in the Crimea, and is very scarce in the Caucasus. In Europe it grows in the Balkans and in isolated localities in Sicilia. It grows from about 300 to 2300 m a.s.l. reaching its highest in south-east Anatolia in the region of Hakkari.

C. tournefortii withstands drought and intense heat better than the other west-asiatic species of the genus. It grows in dry, warm, mountain slopes, in rock fissures, ravines, etc., usually singly or in rather small groups. Generally it does not occur in forests communities. It has no economical value as it is much dispersed and is rather small.

References: 78, 103 (3), 104 (2), 141, 218 (1), 253.

***Ulmus* L.**

97. *Ulmus glabra* Hudson

Syn.: *U. scabra* Miller, *U. montana* With., *U. elliptica* C. Koch

Tree 35 - 40 m high found exclusively in Europe and south-west Asia.

In Asia *U. glabra* occurs in the Caucasus, in Anatolia, Syria and Iran. With the exception of the Caucasus, where it grows quite frequently it is rather scarce in south-west Asia. In Anatolia it is recorded only from scattered localities in the north and south part of the country, while in Syria it is found in one locality near Latakia where it reaches its most southern locality. *U. glabra* grows in the north Iran, in Azerbaydzhan (Qareh-Dagh) and along the shores of the Caspian Sea from Talish to Gorgan. The highest localities for the species

are found in Iran to about 1500 m a.s.l. (Qareh-Dagh), in Anatolia (the provinces of Kayseri, İçel, Egridir) to about 1800 m, and in the Caucasus to 2200 m.

U. glabra is a forest species. It grows mostly in fertile and rather humid localities, where it forms a really splendid tree. Just as in Europe it never grows in large concentrations in south-west Asia. Singly, usually as a constituent of deciduous forests, it is found in rather humid valleys of rivers and streams, in ravines, etc. It seldom grows in open places. It is sometimes planted along roads, around houses, etc.

Though the wood of *U. glabra* has many good characteristics it has no great economic value due to its scattered distribution.

References: 103 (3), 104 (2), 141, 218 (1), 253.

98. *Ulmus minor* Miller

Syn.: *U. campestris* L. nom. ambig., *U. carpinifolia* G. Suckow

Tree 20 - 30 m tall, but often much smaller. The area of *U. minor* covers mainly Europe and south-west Asia but a few localities are known in North Africa. In south-west Asia *U. minor* is common in the Caucasus, in Anatolia and north Iran, but is not so frequent in Israel, Syria, Iraq and south Turkmeniya (Kopet Dag).

A species often planted along roads, near houses, etc. It naturalizes easily so in some regions, mainly in the south-east regions of its occurrence (Anatolia, Iran, Iraq, and south Turkmeniya) its natural area is not clearly defined.

U. minor is exceptionally variable, yet within it only two taxa of lower rank, having definite separate geographical areas can be distinguished – subsp. *minor* and subsp. *canescens* (Melville) Browicz et J. Zieliński. The area of subsp. *canescens* covers north Israel, west Syria, Cyprus, coastal regions of south and west Anatolia, the south Balkans, Cyrenaica, Algeria, Sicilia and Sardinia.

Altitudinally *U. minor* occurs from sea-level to over 2000 m. Just as is the case in *Ulmus glabra* Hudson, the highest localities are in south-west Asia, but it may well be that some of them are as a result of man's activities. The highest, and most probably natural, locality is recorded from north Iran in the Elburz mountains at 2100 m a.s.l.

U. minor grows in dry localities: on sunny mountain and ravine slopes, etc., but also in damp flood plains along rivers, streams, etc., either singly or in small groups, in open places or mixed in deciduous forests. In south-west Asia big trees of *U. minor* may be found in natural forest communities. In woodless regions, with the exception of specimens protected by man, large trees of this species are very rare. Grazed by sheep and goats it grows, however, in a shrub form, because of its suckering ability.

The wood of *U. minor* is used in furniture manufacturing, and to make sleepers.

References: 49, 103 (3), 104 (2), 141, 152, 218 (1), 253.

99. *Ulmus wallichiana* Planchon

A large tree to 30 m high and with a trunk over 2 m in diameter. A Himalayan species its area stretches from central Nuristan in east Afghanistan, through Kashmir, along the Himalayas to Nepal as far as 85° E, more or less between 1000 - 3500 m a.s.l.

U. wallichiana occurs quite often in regions situated between the river Indus and the upper course of the Ganges. Both east and west of these regions it is much more dispersed and rare.

U. wallichiana needs much humidity and a fertile habitat and so grows in humid localities in river valleys, in gorges etc., but never forms pure communities. Being so dispersed this species has no great economic value.

The wood of *U. wallichiana* is used locally to make furniture, and its strong inner bark is utilized in some regions to produce ropes, fuses, etc. Leaves and young shoots are given as fodder to cattle and so this elm is sometimes planted near houses.

References: 30, 153, 253.

100. *Zelkova carpinifolia* (Pallas) C. Koch

Syn.: *Z. crenata* Desf., *Z. hyrcana* Grossh. et Jarm.

Tree growing strongly and quickly to a height of 30 - 35 (40) m with a trunk diameter of 2 - 3 m.

The area of *Z. carpinifolia* is divided into an eastern and western region. The former, much larger and richer, lies in the forests of Talish (USSR), adjoining the Caspian Sea, and in the forests of north Iran, while the western, much smaller, lies beyond the Transcaucasian Mts., in west Georgia (Imeretia, Guria, Abkhazskaya ASSR, Adzhariya). In addition single localities, isolated from these two regions, are known from the Karabakh mountain range in south Azerbaydzhan (USSR), in south-east Anatolia, and in the west Iranian Kurdistan. These testify to the area of this species having been much wider but having become much smaller, broken and poorer because of felling and grassing-down (e.g. in the Caucasus). The species most closely related to *Z. carpinifolia* – *Zelova abelicea* (Lam.) Boiss. (= *Z. cretica* (Sm.) Spach), is only met in the mountains of Central Crete; it was also recorded from Cyprus a hundred years ago, but this has not been confirmed.

Z. carpinifolia is a shade-loving and thermophilous species, most particular about the soils. It grows best in fresh and moist (but not boggy) soils that are deep and humid, sandy and clayey. It can also be found in dry and stony areas, but then it is weak and crooked.

The species forms either pure woods (*Zelkovetum*) or grows more or less singly in mixed broad-leaved forests, especially oak and hornbeam (*Quercus castaneifolia* C. A. Mey., *Q. petraea* (Mattuschka) Liebl. subsp. *iberica* (Stev.) Krassiln., *Carpinus betulus* L.) or woods composed of *Quercus castaneifolia* C. A. Mey. and *Parrotia persica* C. A. Mey., or elm or in *Albizzia julibrissin* Durazz. communities. It is found from the plain of the Caspian Sea up to 1500 m in the Talish Mts. and in Iran and even to 1550 m in Anatolia.

Because of great exploitation *Z. carpinifolia* is becoming scarcer and scarcer and therefore its felling is now prohibited in Iran. The wood of this species is dense, hard and elastic, rather light, resistant to dampness, and is used for furniture and in the building trade; in Iran it has been used for door-frames and windows of mosques.

References: 63, 103 (3), 104 (2), 141, 203, 205, 218 (1), 253.