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The genus *Crataegus* (Rosaceae) in Greece

JEAN I. BYATT

Résumé

Byatt, J. I. (1976). Le genre *Crataegus* (Rosaceae) en Grèce. *Candollea* 31: 283-301. En anglais.

Cette contribution, fondée sur des spécimens d'herbier tant anciens que modernes, ainsi que sur le travail de l'auteur dans le terrain, comprend une clé de détermination, des synonymies, la citation complète des spécimens et des cartes de répartition. L'écologie des espèces et la variation infraspécifique sont discutées. Une attention particulière s'est portée sur la classification subsécifique de *Crataegus monogyna*: une seule des sous-espèces méditerranéennes reconnues jusqu'ici, subsp. *azarella*, s'est montrée suffisamment distincte pour justifier son statut taxonomique. Plusieurs autres modifications du traitement adopté dans "Flora europaea" sont suggérées en ce qui concerne la nomenclature, les descriptions et répartitions. Deux hybrides intersécifiques sont considérés et l'un d'eux (*C. x peloponnesiaca*) est décrit pour la première fois.

Abstract

Byatt, J. I. (1976). The genus *Crataegus* (Rosaceae) in Greece. *Candollea* 31: 283-301. French abstract.

The account, based on old and recent herbarium material and the author's own field work, includes a key, synonymies, full specimen citations and distribution maps. The ecology and infraspecific variation are discussed. Particular attention is given to the subspecific classification in *Crataegus monogyna*, where only one of the hitherto recognized Mediterranean subspecies, subsp. *azarella*, is thought to be sufficiently distinct to warrant taxonomic recognition. Several other changes with respect to the recent treatment of the genus in "Flora europaea" are implied, concerning nomenclature, description and distribution. Two interspecific hybrids are reported, one of them (*C. x peloponnesiaca*) being described as new.

Introduction

Considerable new material of the genus *Crataegus* collected recently in Greece has been examined by the author. The chief sources of this material are the post-war collections of Goulimis (ATH), and collections made from 1968 onwards by the staff of the Goulandris Natural History Museum at Kifisia (ATH). Valuable material has also been contributed by Polunin (LTR) who collected from May to September 1975, and by the Westfield College expedition which was also in Greece during May of the same year. These new collections, in conjunction with older herbarium material mainly from the British Museum (BM) and Kew (K),

but also loaned from other European herbaria, have made it possible to present an up-to-date assessment of the distribution and habitats of the Greek species of the genus *Crataegus*.

The geographical position and climate of Greece combine to make it one of the most interesting areas in Europe for the study of hawthorns. Only in the more northerly parts of the Balkans and the Crimea is similar or greater diversity encountered. The genus *Crataegus* is primarily Asiatic, all the available evidence indicating that it originated in Asia and spread westwards. *C. sect. Sanguineae* and sect. *Pentagynae* only penetrate into eastern Europe, sect. *Azaroli* is centred around the Black Sea and the Mediterranean, only sect. *Crataegus* is widespread in northern and western Europe.

There are two important factors which may account for the greater diversity of species in south-eastern Europe. Firstly, it is the easiest migration route westwards from the main centres of diversity in Soviet Central Asia, the Caucasus and the Crimea. Secondly, there is a considerable range of climate, with very hot dry conditions in some parts, but often combined with cooler habitats on the tops of mountains, which again afford migration routes both in east-west and north-south directions. Hence the presence of mountains enables some of the predominantly northern species of *C. sect. Crataegus* to penetrate southwards into the Balkan peninsula where they overlap with *C. sect. Azaroli*.

It will be seen from the distribution maps (fig. 2 and 3) that the most important species of hawthorns in Greece are *C. monogyna* Jacq. (*C. sect. Crataegus*), and *C. orientalis* Pallas, *C. heldreichii* Boiss., and *C. pycnoloba* Boiss. & Heldr. (*C. sect. Azaroli*). The name *C. orientalis* is used here rather than *C. laciniata* Ucria since the latter name is misapplied in "Flora europaea" (Byatt 1977).

It is noteworthy that the hawthorns found in Crete differ markedly from those of the Greek mainland and many of the other islands. All Cretan specimens of *C. monogyna* appear to belong to subsp. *azarella*, *C. azarolus* is confined to Crete and one or two islands near to the Turkish mainland, and other members of *C. sect. Azaroli*, which might be thought to be suitably adapted to grow on the Cretan mountains, are all absent. These facts almost certainly point to a difference in geological history and migration routes.

Key to the genus *Crataegus* in Crece

- | | | |
|-----|--------------------------------------------------------------------------------------------------------------|--------------------------|
| 1a. | Style 1 | 2 |
| 1b. | Styles more than 1 | 3 |
| 2a. | Leaf-lobes \pm entire or with a few apical teeth | 2. <i>C. monogyna</i> |
| 2b. | Leaf-lobes \pm serrate to base (N. Greece) | 1. <i>C. curvisepala</i> |
| 3a. | Styles 2-3 | 4 |
| 3b. | Styles 4-5 | 5 |
| 4a. | Leaves tomentose, leaf-lobes often narrow, entire, with rounded apex (Crete and E. Aegean Islands) | 3. <i>C. azarolus</i> |

- 4b. Leaves lanate, leaf-lobes usually narrow, incised, oblong, pointing forwards 7. *C. x albanica*
- 5a. Leaves with silky sericeous hairs (Peloponnisos) 6
- 5b. Leaves without silky sericeous hairs 7
- 6a. Leaves silvery with dense sericeous hairs 5. *C. pycnoloba*
- 6b. Leaves green with scattered sericeous hairs 8. *C. x peloponnesiaca*
- 7a. Leaf-lobes narrow, oblong, pointing forwards 4. *C. orientalis*
- 7b. Leaf-lobes obovate, spreading \pm horizontally 6. *C. heldreichii*

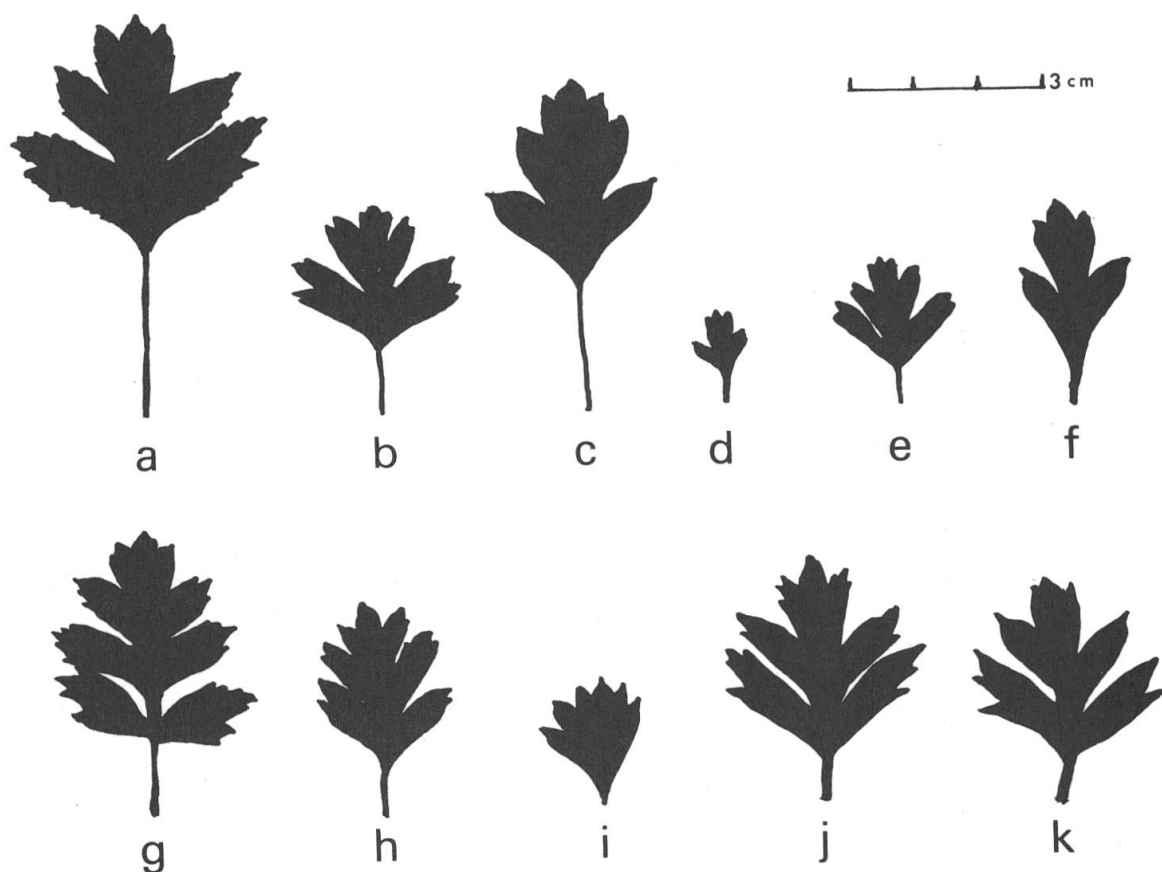


Fig. 1. — Representative leaves from non-flowering branches of some Greek *Crataegus*: a, *C. curvisepala*, E. Macedonia, Greuter 11234; b, *C. monogyna*, Peloponnesus, Byatt 54752; c, *C. monogyna* subsp. *azarella*, Crete, Polunin 13889; d, *C. monogyna*, Karpathos, Greuter 5361; e, *C. monogyna*, Ikaria, Rechinger 4396; f, *C. azarolus*, Crete, Rechinger 13981; g, *C. heldreichii*, Attica, Byatt 40753; h, *C. x peloponnesiaca*, Peloponnesus, Polunin 12876; i, *C. pycnoloba*, Peloponnesus, Polunin 12853; j, *C. orientalis*, Thessalia, Polunin 13833; k, *C. x albanica*, Thessalia, Polunin 13831.

Taxonomic treatment

Crataegus L., Sp. Pl.: 475. 1753, et Gen. Pl. ed. 5: 213. 1754.

Lit.: Diapoulis (1933), Pojarkova (1939a), Franco (1968a), Gladkova (1968), Browicz (1972), Dzekov (1974).

Crataegus L. sect. *Crataegus*

= *C.* sect. *Oxyacanthae* Zabel ex C. K. Schneider, Ill. Handb. Laubholz. 1: 768. 1906.

Inflorescences lax. Styles always 1 in Greek species. Pyrenes with distinct lateral grooves. (Map fig. 2.)

1. *Crataegus curvisepala* Lindman, Svensk Fanerogamfl.: 307. 1918.

= *C. oxyacantha* L., Sp. Pl.: 477. 1753, nom. ambig. (cf. Byatt 1975a).

= *C. calycina* subsp. *curvisepala* (Lindman) Franco in Feddes Repert. 79: 39. 1968.

Ic.: fig. 1a; Byatt (1975a, tab. 2).

Num. Chromos.: $2n = 68$.

This is a predominantly northern and eastern European species and is at the southern limit of its European range in northern Greece, although it penetrates a little further south in Asia Minor. This species has recently been reported by Dzekov (1974) from nine mountainous sites in Makedonija, growing at altitudes between 900 and 1540 m. The two sites known in Greece are also mountainous, at 1300 and 1600 m. *C. curvisepala* is a shade-loving species, usually growing in woods or thickets where it is not exposed to hot, dry conditions. The Macedonian populations have probably spread from the mountains of Bulgaria, since the species is not reliably reported from any other parts of Yugoslavia.

One of the *Alston & Sandwith* specimens has immature fruit showing that it is *C. curvisepala* subsp. *curvisepala*, and this would be expected as all the populations in surrounding areas are also subsp. *curvisepala*. Greuter's specimen shows some abnormality in its characters which suggest that it may have been introgressed by genes from *C. monogyna*. Unfortunately it is not known whether this specimen formed part of a mixed population or not.

*Specimina visa*¹

Macedonia, Florina: Serres: in m. Vrondots, 1500-1600 m, 17.6.1973, *Greuter 11234* (ATH, herb. Greuter). Kristalopiysi, 1300 m, 19.6.1932, *Alston & Sandwith 392* (BM, K).

¹The names of regions, administrative provinces (nomoi) and/or islands are printed in *bold-face italics*.

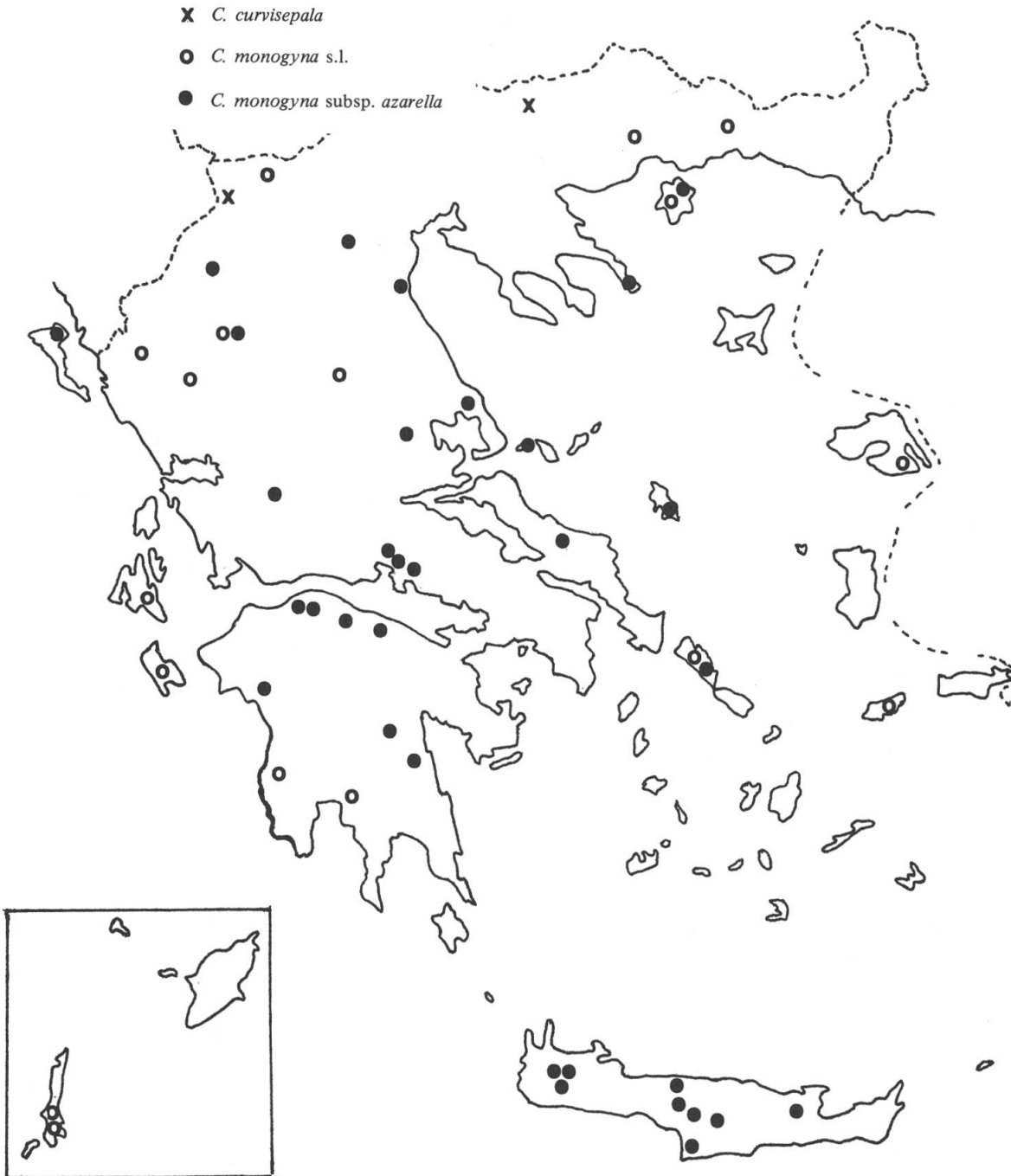


Fig. 2. — Distribution of *Crataegus* sect. *Crataegus* in Greece.

2. *Crataegus monogyna* Jacq., Fl. Austr. 3: 50, tab. 292, fig. 1. 1775.

Lit.: Grisebach (1843), Pojarkova (1960), Franco (1968b), Franco & Rocha Afonso (1968).

Ic.: fig. 1b-e.

Num. Chromos.: $2n = 34$.

This is the only species of *C.* sect. *Crataegus* which is widespread in Greece, and here, as in other parts of its range, it shows a remarkable capacity for colonisation of diverse habitats. It is frequently found on mountain tops at altitudes around 1200 m, and even as high as 1800 m in Macedonia. It does not often grow at very low altitudes in Greece, but is found near Igoumenitsa on a riverside site at 150 m, and no doubt there are other similar isolated examples. Elsewhere it is found around 700 m, occasionally lower, on the Greek Islands and Crete. In the Peloponnisos *C. monogyna* appears to be replaced by *C. heldreichii* at lower, hotter altitudes. *C. monogyna* is most often a plant of open, scrubby places, but it is also found in woodlands on the mountains, even in the shade of a small pine wood on Mount Taiyetos. As in other parts of its range, it grows on a wide variety of soils, including sand and limestone.

The species of *Crataegus* which is most often found growing with *C. monogyna* is *C. orientalis*, both species frequently growing in open, disturbed, scrubby habitats at around 1200 m.

The problem of the subspecies of *C. monogyna* is very complex. There are certain areas in the extremely wide range of this species where plants are fairly constant in leaf-size, indumentum and leaf-texture, and these characters are used prominently in the subdivisions made by Franco (1968a; see tab. 1). However, in other areas a wide variation in these characters is encountered and many plants fall outside the limits of the supposed subspecies.

Franco names three subspecies which grow in the Balkan peninsula, *C. monogyna* subsp. *monogyna*, *azarella* and *aegeica*, the latter two subspecies being based on the species of Grisebach (1843) and Pojarkova (1960). Unfortunately "subsp. *monogyna*" seems one of the least realistic of the subspecies and examination of specimens from mountainous areas of Switzerland, N. Italy and N.E. France show that although many plants growing in these areas have leaves of the appropriate dimensions, they do not have a glabrous hypanthium. There is a rather wide range of leaf-size in Yugoslavia, and while the majority of plants have a glabrous hypanthium, many do not; and certainly by no means all of those plants having a villous hypanthium are *C. monogyna* subsp. *azarella*.

When Greek material is considered it shows two striking characteristics. Firstly, the majority of plants are small-leaved, having leaf-lengths on the flowering branches of less than 25 mm, and secondly, the Greek plants are much more villous than those from other parts of Europe. If the Greek plants are compared with those from the western end of the Mediterranean, in southern Spain, it is found that many Spanish plants are also small-leaved, but this character is not so marked as in the Greek material. Spanish populations are mostly glabrous, except in a few mountainous areas (Franco & Rocha Afonso 1968) where *C. monogyna* subsp. *azarella* is found.

It will be appreciated from tab. 1 that many villous plants will fit *C. monogyna* subsp. *azarella*, and the distribution map (fig. 2) shows that more than half the

<i>C. monogyna</i> subsp.	<i>monogyna</i>	<i>brevispina</i>	<i>aegeica</i>	<i>aegeilla</i>
<i>Area</i>	France to S. Ukraine	Iberian peninsula and Is. Balears	E. Aegean	S.E. Europe, Sicily, Italy and Spain
<i>Habitat</i>	submontane	hedges and thickets near stream		dry mountain thickets
<i>Leaf-length</i> ¹	25-35 mm	10-30 mm	10-20 mm	15-30 mm
<i>Petiole length</i> ¹	5-15 mm	3-15 mm	3-6 mm	4-13 mm
<i>Abaxial leaf-surface</i>	slightly coriaceous, light green hairs on veins and in vein axils only	coriaceous, glaucous as <i>monogyna</i>	chartaceous, light green as <i>monogyna</i>	subcoriaceous, light green, entire surface with hairs, at least when young
<i>Hypanthium</i>	glabrous	usually glabrous	glabrous	villous
<i>Floral diameter</i>	8-15 mm	8-15 mm	8-10 mm	8-15 mm

¹ Leaf dimensions refer to leaves on flowering branches.

Tab. 1. — Comparison of the Mediterranean subspecies of *C. monogyna*, as defined in "Flora europaea" (Franco 1968a).

Greek plants belong here and probably all those in Crete. Of the glabrous specimens, some may fit *C. monogyna* subsp. *aegeica* but very few will fit subsp. *monogyna* because of leaf-size. Also many small-leaved plants are excluded from subsp. *aegeica* because they have larger flowers and/or glaucous leaves. Such plants must either be considered to be *C. monogyna* subsp. *brevispina* (confined by Franco to the western Mediterranean) or a new subspecies. It will also be noticed that the main difference between *C. monogyna* subsp. *monogyna* and subsp. *aegeica* lies in the size of the leaves and flowers, hence these forms must be considered to be very closely related, reduction in size being one of the general characteristics of south-eastern European material of *C. monogyna*.

Whether any of the plants of *C. aegeica* Pojark. constitute a separate taxon is uncertain. The paratypes cited by Pojarkova from Thasos, Ikaria (fig. 1e) and Karpathos do not form a homogeneous group which can be readily distinguished from other forms of *C. monogyna* growing in the area. The most distinct plants are those from Karpathos, where several similar specimens have been collected, including the type and one of the paratypes of *C. aegeica* as well as a more recent specimen of Greuter (fig. 1d). Dr. Greuter (pers. comm.) is of the opinion that the plants on the island of Karpathos should form a separate taxon of at least subspecific rank, since he says all plants growing there are similar and have many distinct characters. He also informs me that the island has been isolated over a long period of time. However, after a careful examination of the specimens I am not convinced that they vary from other plants of *C. monogyna* sufficiently to justify their separation. The leaves are glabrous, very small, mostly 3-lobed, with \pm straight veins and fairly short petioles and lacking the pockets which often characterise the angles between the main and lateral veins on the adaxial surface. However, most of these characters occur fairly frequently in small-leaved forms of *C. monogyna*: for example, curvature of the veins is never very marked in 3-lobed leaves, and pockets and/or hairs in vein angles are not universal in *C. monogyna*. While it may be argued that there is a particular combination of characters in the specimens from Karpathos, these may well characterise a neotenous ecotype growing in poor dry conditions, and further investigation of populations of plants on the island is required before a final decision can be reached.

a. *Crataegus monogyna* subsp. *azarella* (Griseb.) Franco in Collect. Bot. (Barcelona) 7: 471. 1968.

= *C. azarella* Griseb., Spicil. Fl. Rumel. 1: 88. 1843.

lc.: fig. 1c.

Specimina visa

Thracia, Xanthi: ad "Bojadschilar", 23.6.1936, *Rechinger 10080* (K).

Thessalia, Pieria: "Gritza" pr. Litohoro, 24.8.1975, *Polunin 13891* (LTR). *Larisa*: Farsala, 20.8.1975, *Polunin 13718* (LTR). *Magnisia*: pr. Volos, 4.1961, *Polunin 6548* (LTR). *Grevena*: pr. Samarina, 1200 m, 14.9.1937, *Balls & Gourlay 10348* (BM, K).

Epirus, Ioannina: Metsovo, 1200 m, 25.5.1975, *Byatt 59751* (herb. Byatt).

Ins. Ioniae, Kerkira: in m. Pandokrator, 22.5.1975, *Polunin 12602* (LTR).

Graecia media, Evritania: in Pindo Tymph., 6.5.1896, *Sintenis 193* (K); Karpenisi, 950 m, 7.8.1926, *Mattfeld 2615* (K). **Viotia:** in planitie Livadhi, 1250 m, 29.5.1970, *Polunin 10223* (LTR); Arahova, 700 m, 18.5.1975, *Byatt 44751* (herb. Byatt); Levadhia, 200 m, 29.5.1974, *Byatt 1741* (herb. Byatt). **Attiki:** ad fl. Kifissos, 4.1847, *Heldreich* (BM); in m. Parnis, 5.6.1857, *Heldreich 1688* (K); id., 25.4.1853, *Orphanides* (K); id., 17./27.4.1930, *Guiol 1212* (BM); id., 800 m, 1875, *Orphanides* (BM).

Peloponnesus, Ahaia: pr. Patras, 20.4.1926, *Bornmüller 622* (LD); in m. Panahaiko, 17.8.1975, *Polunin 13708* (LTR). **Korinthia:** Trikala, 1200 m, 20.5.1975, *Byatt 50751 & 50752* (herb. Byatt).

Reg. Aegaea occ., Evvia: pr. Steni, 19.4.1975, *Stearn E 69* (BM). **Skiros:** 700 m, 29.4.1927, *Rechinger 861* (LD). **Skiathos:** 4.9.1975, *Polunin 138526* (LTR). **Yioura:** 25.5.1896, *Leonis* (PR).

Reg. Aegaea sept., Athos: 19.4.1934, *Hill, Sandwith & Turrill 2493* (K). **Thasos:** pr. Panayia, 1839, *Grisebach* (GOET, holotypus); in m. Ilias, 24.5.1891, *Sintenis & Bornmüller 514* (LD); Theologos, 31.5.1891, *Sintenis & Bornmüller 590* (BM, G, K, PR).

Reg. Aegaea or., Samos: in m. Ambelos, 1100 m, 16.6.1932, *Rechinger 2118* (BM).

Reg. Aegaea austr., Creta, Lasithi: Lasithi, 8.5.1914, *Gandoger 2080* (K); inter Ayio Pnevma et Koudhoumalia, 1000 m, 13.7.1942, *Rechinger 14374* (BM). **Iraklio:** Apladhiana, 200-350 m, 1.5.1960, *Greuter 2832* (herb. Greuter). **Rethimni:** Rethimno, 1.7.1974, *Barclay 3720* (K); in m. Psiloritis, 10.6.1899, *Baldacci* (BM); id., planities Nidha, 1450 m, 7.7.1942, *Rechinger 14285* (BM, K); id., supra Arkadhi, 1450 m, 31.5.1915, *Gandoger 12476* (K). **Hania:** pr. Vrises, 110 m, 28.3.1962, *Greuter 4041* (ATH, herb. Greuter); Lakki, 27.9.1975, *Polunin 13904* (LTR); Omalos, 27.9.1975, *Polunin 18558* (LTR); id., 800-1100 m, 25.4.1942, *Rechinger 12323* (BM, G); id., 1100 m, 28.6.1962, *Greuter 4802* (herb. Greuter).

Reg. Aegaea centr., Andhros: 10.9.1968, *Stamatiadhou 9414* (ATH).

b. *Crataegus monogyna* Jacq. sensu lato (excl. subsp. *azarella* (Griseb.) Franco).

Specimina visa

Thracia: "Okman Euren", 800 m, 17.6.1934, *Tedd* (K). **Xanthi:** ad "Bojad-schilar", 16.10.1933, *Tedd* (K); id., 5.5.1932, *Tedd* (K); "Shakin", 8.8.1932, *Tedd 882A* (K).

Macedonia, Dhrama: "Volaka", 1000/1800 m, 21.9.1926, *Mattfeld* (K). **Flo-rina:** Pisodheri, 5.6.1932, *Alston & Sandwith 179* (BM, K).

Epirus, Ioannina: supra Metsovo, 1200 m, 25.5.1975, *Byatt 59751 & 59752* (herb. Byatt); pr. Ioannina, 500 m, 24.5.1975, *Byatt 58751* (herb. Byatt); pr. Vrousina, 150 m, 25.5.1975, *Byatt 62755* (herb. Byatt).

Ins. Ioniae, Kefallinia: in m. Enos, 1200 m, 13.5.1926, *Bornmüller 6026* (K, LD).

Peloponnesus, Ahaia: pr. Mega Spileo, 900 m, 19.5.1965, *Byatt 49752* (herb. Byatt). **Lakonia:** in m. Tayietos, 1200 m, 22.5.1975, *Byatt 54751 & 54752* (herb. Byatt).

Reg. Aegaea sept., Thasos: Limenas, 4.6.1891, *Sintenis & Bornmüller 668* (PR), 669¹ (BM, K).

Reg. Aegaea or., Lesvos: Mitilini, 17.5.1969, *Stamatiadou 9516* (ATH). *Samos:* in m. Ambelos, 350-800 m, *Stamatiadou 9522* (ATH); *Ikaria:* in m. Atheras, 700 m, 18.4.1934, *Rechinger 4396*¹ (LD).

Reg. Aegaea austr., Karpathos: in m. Lastos, 700 m, 15.6.1935, *Rechinger 8177*¹ (K); in m. Kolla, 900-950 m, 17.5.1963, *Greuter 5361* (herb. Greuter).

Reg. Aegaea centr., Andhros: Arni, 425 m, *Stamatiadou 7764* (ATH).

Crataegus sect. *Azaroli* Loudon, Arbor. Fruticet. Brit. ed. 2: 826. 1844.

= *C.* sect. *Orientalis* Zabel ex C. K. Schneider, Ill. Handb. Laubholz. 1: 768. 1906.

Inflorescences compact. Styles 2-5. Pyrenes smooth, without lateral grooves. (Map fig. 3.)

Plants of *C.* sect. *Azaroli* grow mainly around the eastern Mediterranean and Black Sea, and predominate in Greece where all the European species are represented. While the section is also important in other areas, e.g. Turkey, nowhere else does it contribute the majority of species present.

Plants of *C.* sect. *Azaroli*, with their lacinate, hairy leaves, seem well adapted to grow in fairly open sites on shallow, dry soil where there is a sharp contrast between summer and winter temperatures. Some of the Greek species are very thorny shrubs with frequent lateral branches ending in stout spines. These characteristics have combined to permit plants of this section to survive in highly grazed areas. The mountainous species most often occur in degraded *Abies* and *Pinus* forest, while *C. heldreichii* is found lower down in the highest altitudes of the maquis, often in the mixed "Lentiscus-Carob-Myrtle maquis" referred to by Polunin & Huxley (1970). Species of this section often grow with other spiny shrubs, sometimes including *C. monogyna*, which has many characteristics in common with *C.* sect. *Azaroli*.

3. *Crataegus azarolus* L., Sp. Pl.: 477. 1753.

Lit.: Pojarkova (1939b).

Ic.: Pojarkova (1939b: 443).

C. azarolus, a species with only 2-3 styles, is less important in Europe than in south western Asia where it is often known as *C. aronia* Bosc. Its European distribution has been confused, since it has been cultivated in some Mediterranean areas of Italy and France since Roman times. The cultivated form of this plant, which is sometimes treated as a separate species or subspecies, tends to have larger leaves and fruit and less thorns than the wild plant, but does not differ from it more than would be expected in a cultivated variety. There is no consistent difference in fruit colour between wild and cultivated specimens. *C. azarolus* var. *aronia* L., the wild form, is found in Crete where it does not ascend to such high altitudes as *C. mono-*

¹Plants cited as paratypes of *C. aegeica* by Pojarkova (1960).

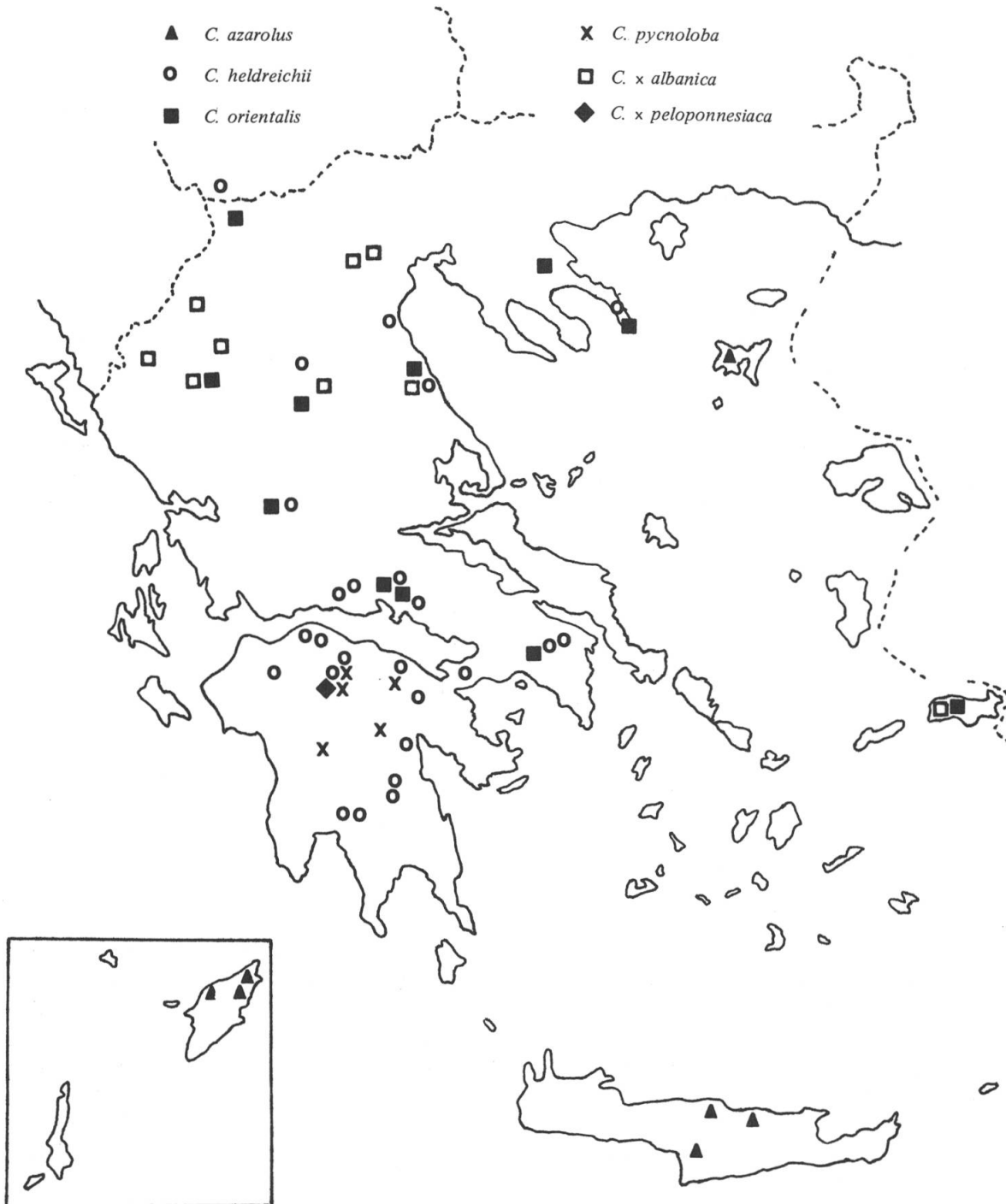


Fig. 3. — Distribution of *Crataegus* sect. *Azaroli* in Greece.

gyna. Some of the plants from Rhodes show signs of mixing of wild and cultivated genotypes.

- a. *Crataegus azarolus* var. *aronia* L., Sp. Pl. 477. 1753.
 = *C. aronia* (L.) Bosc ex DC., Prodr. 2: 269. 1825.
 = *C. azarolus* subsp. *aronia* (L.) H. Riedl in Rech. fil., Fl. Iran. 66: 54. 1969.

Ic.: fig. 1f.

Num. Chromos.: $2n = 34$.

Specimina visa

Reg. Aegaea or., Limnos: 22.-28.5.1927, *Rechinger 1381* (BM).

Reg. Aegaea austr., Rodhos:¹ inter Salakos et Dhimilia, 10.6.1870, *Bourgeau* (BM, K); inter Kallithea et Asgourou, 100 m, 5.7.1935, *Rechinger 8587* (BM, K); Koskinou, 29.9.1955, *Goulimis 19651* (ATH). *Creta*: *Tournefort* (BM, pro *Mespilus cretica*). *Iraklio*: Gorgolaino, 14.5.1915, *Gandoger 10971* (K); Prinias, 16.5.-1915, *Gandoger 11254* (K); distr. Malevizi, 4.6.1899, *Baldacci 72* (BM); Gazi, 25.6.1942, *Rechinger 13981* (BM); Spilia, 60 m, 4.5.1971, *Stamatiadou 12411* (ATH); distr. Kenouryio, 500-600 m, 16.8.1971, *Petamidhis 18431* (ATH). *Rethimni*: in m. Psiloritis supra Vizari, 12.8.1893, *Baldacci 183* (BM).

4. *Crataegus orientalis* Pallas ex Bieb., Fl. Taur.-Cauc. 1: 387. 1808.
 = *Mespilus odoratissima* Andrews in Bot. Repos. 9: 590. 1809.
 = *C. tanacetifolia* var. *taurica* DC., Prodr. 2: 629. 1825.
 = *C. pycnoloba* var. *parnassica* Diapoulis in Repert. Spec. Nov. Regni Veg. 34: 57, tab. 147, fig. 5.
 = *C. flabellata* Heldr. in schedis Herb. Graec. Norm. a. 1852, num. 632.
 – *C. laciniata* subsp. *laciniata* sensu Franco (1968a: 77), non *C. laciniata* Ucria.

Lit.: Dzekov (1974); Byatt (1977).

Ic.: fig. 1j; Pojarkova (1939a: tab. 29, fig. 1); Dzekov (1974: fig. 25-31).

Num. Chromos.: $2n = 68$.

C. orientalis has a widespread distribution around the Black Sea as well as in the Balkan peninsula, while a very closely allied plant, *C. pubescens* (C. Presl) C. Presl, is found in Sicily, North Africa and Spain. *C. orientalis* grows on mountains in Greece, often in disturbed situations, at altitudes above 1100 m.

The plant described by Diapoulis (1933) as *C. pycnoloba* var. *parnassica* may form a link between this species and *C. pycnoloba*. Diapoulis' example was a plant (*Orphanides 2720*) growing on Mt. Parnassus near Livadi above Arahova. Diapoulis' figure shows a plant with leaves similar in size to those of *C. pycnoloba* but varying in the lobe apices, those of *C. pycnoloba* being entire, rounded mucronate, those of var. *parnassica* being incised or serrate. There are two more recent specimens apparently similar to *Orphanides 2720* from a more northerly area of

¹Some of the specimens from Rhodes are intermediate with cultivated forms of *C. azarolus*.

central Greece, both from Mt. Timfristos above Karpenisi (*Grebenščikov*, 10.7.1938, and *Goulimis*, 21.6.1951). These two specimens appear to be identical, having 4-5 styles, leaves of maximum dimensions 11 × 8 mm and petiole 2 mm, with incised leaf-lobes. Neither specimen has ovate glandular bracts on the hypanthium as has *C. pycnoloba*. It would therefore appear that all the above-mentioned plants belong to a small-leaved form of *C. orientalis*, not to *C. pycnoloba*. This small-leaved form may be a link with *C. pycnoloba*, but since Diapoulis also shows an equally small-leaved form of *C. tanacetifolia*, these small-leaved forms may have no particular taxonomic significance.

Both the location and the description of *C. pycnoloba* var. *parnassica* suggest that this is also the same as *Heldreich* 632, of 1852, distributed as *C. flabellata*, now known as *C. orientalis*. Another *Heldreich* specimen of *C. flabellata* from Mt. Timfristos, of 1857, also fits the description, but other *Heldreich* specimens of *C. flabellata* have larger, normal *C. orientalis* size leaves.

Specimina visa

Macedonia, Kavala: in m. Pangeo, 29.8.1959, *Goulimis* 1969 (ATH). **Florina:** Armensko, 1200 m, 7.6.1932, *Alston & Sandwith* 202 (K). **Kozani:** inter Petrili et Mouzakion, 1500 m, 12.8.1937, *Balls & Gourlay* 3858 (BM, K).

Thessalia, Larisa: in m. Ossa, 1100 m., 28.8.1975, *Polunin* 13833 (LTR).

Epirus, Ioannina: supra Metsovon, 1200 m, 25.5.1975, *Byatt* 59756, 59757 & 59758 (herb. Byatt).

Graecia media, Evritania: in m. Timfristos 1200 m, 30.7.1857, *Heldreich* (E, UPA); id., ad Karpenisi, 1400 m, 23.7.1932, *Rechinger* 2876 (BM); id., 1500 m, 16.7.1938, *Grebenščikov* (BM, K); id., 21.6.1951, *Goulimis* (ATH). **Boetia:** in planitie Livadhi, 1200 m, 8.7.1857, *Heldreich* 632 (BM, FI, K, LI); in m. Parnassos vs. refugium, 1000 m, 18.8.1975, *Polunin* 13712 (LTR). **Attica:** in m. Parni, 1200 m, 15.5.1975, *Byatt* 40751 & 40752 (herb. Byatt).

Reg. Aegaea sept., Athos: *Sibthorp* (BM, specimen mixtum); 29.7.1871, *Janka* (K); pr. Panayia, 1900 m, 29.8.1862, *Orphanides* 410 (P).

Reg. Aegaea or., Samos: in m. Kerketefs, 1.7.6.1965, *Goulimis* 19675 (ATH).

5. *Crataegus pycnoloba* Boiss. & Heldr. in Boiss., *Diagn. Pl. Or. Nov. ser. 2*, 2: 146. 1856.

Lit.: Quézel (1964).

Ic.: fig. li; Diapoulis (1933: tab. 147, fig. 4).

C. pycnoloba replaces *C. orientalis* in the Peloponnisos where it grows at similar altitudes, above 1000 m. *C. pycnoloba* provides one of the best examples of endemism in the European members of the genus. It differs from *C. orientalis* in the smaller size of its leaves, flowers and fruit, and in the shape of the leaf-lobes, which are narrow, entire, with a rounded mucronate apex. The most obvious point of distinction is in the indumentum, since most of the plant is closely covered in silvery sericeous hairs. *C. pycnoloba* is more reminiscent of the Turkish endemic *C. tanacetifolia* (Lam.) Pers. than of *C. orientalis* in its leaf-shape and glandular indumentum, but differs from this species, also, in the smaller size of its

organs and in the nature of its hairs. *C. tanacetifolia* differs from both *C. pycnoloba* and *C. orientalis* since it has white anthers and yellow fruit. On balance *C. pycnoloba* appears to be slightly nearer to *C. orientalis* than to *C. tanacetifolia*. All three plants grow at similar altitudes and are late-flowering in June or early July, and hence have a short season for the development of their relatively large fruits. These species most often grow as scattered shrubs, but Quézel (1964) reports that *C. pycnoloba* is an important component of the vegetation in the degraded forest zone on Mount Killini between 1500 and 1700 m where, he says, "la forêt cède la place bien souvent à une broussaille à *Crataegus pycnoloba*".

Specimina visa

Peloponnesus, Ahaia: in m. Helmos, 9.6.1842, *Trevelyan* (K); id., 1400-1600 m, 7.-19.5.1926, *Bornmüller 612* (BM, W); id., 12.7.1932, *Guiol* (BM); id., supra Kalavrita, 1300 m, 16.10.1939, *Davis 980* (K); id., l.d. Kria Vrasi, 25.6.1949, *Goulimis 41* (K); Kalavrita pr. Vrahni, 1400 m, 10.6.1975, *Polunin 12853* (LTR); pr. Kalavrita, 1300 m, 18.6.1975, *Polunin 13051* (LTR); **Corinthia:** in m. Kyllene, 1200-1700 m, 7.1848, *Heldreich* (BM, K; isosyntypes); id., 18.6.1852, *Orphanides 254* (BM, E, FI, K, P, UPA, W, Z; isosyntypes); id., 1.6.1935, *Guiol* (BM); id., 1400-1500 m, 8.6.1969, *Stamatiadou 6560* (ATH); id., pr. Trikala, 5.1874, *Orphanides* (FI); id., 1.6.1931, *Guiol 1883* (BM, E, UPA); id., 1000-1500 m, 21.6.1887, *Heldreich 926* (BM, E, FI, G, K, LD, PR, PRC, S, W); id., 1200-1700 m, 10.-12.6.1937, *Lempert 431* (K, PR); id., ad sanctuarium Ayios Vlasios, 13.-17.7.1954, *Goulimis 19691* (ATH); "Zahouli" pr. Dherveni, 25.6.1893, *Halácsy* (G, W). **Arkadhia:** in m. "Glinitsa" supra Zatouna, 22.6.1870, *Orphanides 712* (P); in m. Menalo, 1500-1700 m, 13.7.1971, *Greuter 9400* (ATH).

Locus excludendus

Epirus, Ioannina: in m. "Mitsikeli" supra Ioannina, 6.1897, *Baldacci* (BM). Specimen sine numero, in indice originali non inclusum; locus verisimiliter erratus est.

6. *Crataegus heldreichii* Boiss., *Diagn. Pl. Or. Nov. ser. 2, 2: 47. 1856.*

Lit.: Dzekov (1974).

Ic.: fig. 1g; Dzekov (1974: fig. 33-39).

Num. Chromos.: $2n = 34$ (see Byatt & Murray 1977).

C. heldreichii has a range intermediate in extent between that of *C. orientalis* and *C. pycnoloba*. It is found in suitable habitats throughout the Greek mainland, but is not recorded from Crete or the Aegean Islands. Its range extends a short distance northwards from Greece, into Albania, Makedonija, and probably southwestern Bulgaria. It is the most markedly xerophytic and thermophilous species of *Crataegus* growing in Europe. In the Peloponnisos, where it is most frequent, it is found on the hottest slopes of the mountains, most often at altitudes between 600 and 800 m, but extending to an upper limit of c. 1100 m, or even occasionally 1400 m, where it may grow with *C. pycnoloba*. However it most often grows

where other *Crataegus* species are excluded by extreme environmental conditions. It is often found on limestone soils, usually as isolated bushes amongst other xerophytic components of the maquis. *C. heldreichii* flowers in Greece in the last two weeks of May and the first week in June.

C. heldreichii is described in "Flora europaea" as having 1-3 styles and pyrenes. This follows the original diagnosis (Boissier 1856), which in turn was probably based on the specimen *Heldreich 2112*, collected in 1851 and 1852 on Mt. Parnis in Attica. This specimen has fruits with apparently a maximum style-number of 3, and it is possible that it has been introgressed by *C. monogyna* subsp. *azarella* which is also reported from Mt. Parnis. However other specimens of *C. heldreichii* collected from this area, both by Heldreich and later collectors, all have (3-)4-5 styles, and Boissier himself must have looked at more material later, as he gave the higher style-number in "Flora orientalis" (1872).

Specimina visa

Macedonia, Pieria: in m. Olimbos supra Litochoro, 400-600 m, 22.7.1927, *Hayek* (W); **Grevena:** montes Hasia, 6.1971, *Crow* (BM).

Thessalia, Trikala: in m. Baba, 24.7.1885, *Hausknecht* (K).

Graecia media, Fokis: "Goumiou" pr. Lidhoriki, 800 m, 18.5.1975, *Byatt 47751* (herb. Byatt); in m. Giona pr. Melandri, 700 m, 18.5.1975, *Byatt 46751 & 46752* (herb. Byatt). **Viotia:** in m. Parnassos, 800 m, 31.5.1974, *Byatt 41741*, et 17.5.1975, *Byatt 41751-41755* (herb. Byatt); id., in m. Pania, 5.1862, *Mill* (K); in planitie Livadhi, 1200-1300 m, 29.5.1970, *Polunin 10223*, et 13.7.1975, *Polunin 13642* (LTR); id., 1200 m, 18.5.1975, *Byatt 45752 & 45753* (herb. Byatt); inter Levadhia et Dhelfi, 320 m, 17.5.1967, *Pfadenhauer* (herb. Greuter). **Attiki:** in m. Parnis, 27.9.1851 et 27.5.1852, *Heldreich 2112* (BM, P, W; isosyntypi); id., 9.1852 et 2.9.1853, *Heldreich* (K); id., 8.7.1954, *Heldreich* (P); id., 8.6.1873, *Heldreich* (BM); id., 20.5.1970, *Polunin 10203* (LTR); id., 1000 m, *Orphanides* (K); id., ad "Potami Goura", 11.5.1930, *Guiol* (BM); id., ad deversorium, 1200 m, 16.5.1975, *Byatt 40753-40757* (herb. Byatt); id., pr. Dhekelia, 1200 m, 16.5.-1878, *Heldreich* (FI, P, W); id., 31.5.1895, *Heldreich 113* (LD, UP); montes Yerania, 1100 m, 6.1931, *Atchley 1091* (K).

Peloponnesus, Ahaia: in m. Panahaiko, 19.-23.5.1949, *Goulimis* (ATH); id., 28.5.1975, *Polunin 12624* (LTR); Kalavrita, 1300 m, 14.6.1939, *Davis 981* (K); id., ad mon. Ayia Lavra, 700-800 m, 6.6.1926, *Mattfeld 1590* (K) et *Bornmüller 619* (BM, K, PR, W); pr. Mega Spileo, 600 et 900 m, 19.5.1975, *Byatt 48751, 49752-49755* (herb. Byatt). **Korinthia:** Trikala, 1100 m, 10.-11.6.1937, *Lempert 439* (K); id., 1200 m, 20.5.1975, *Byatt 50753* (herb. Byatt); ad Nemea veterum, 750-1000 m, 24.5.1970, *Zambelis* (ATH); Velina, 1050 m, 21.5.1972, *Zoumbouli* (ATH). **Arkadhia:** supra Mili, 700 m, 22.5.1975, *Byatt 52751* (herb. Byatt). **Lakonia:** in m. Parnon (Malevo), 27.7.1850, *Orphanides 2919* (UPA); id., 5.6.-1857, *Orphanides 685* (K); id., pr. Spilia, 1500 m, 18.6.1857, *Orphanides 2919* (E, K, PRC, UPA); in m. Taiyetos pr. Tripi, 400 m, 22.5.1975, *Byatt 57751* (herb. Byatt); id., in jugo "Artemisia", 1.8.1962, *Whittle 203* (LTR); inter Tripolis et Sparti, 29.5.1975, *Polunin 12660C* (LTR); id., in loc. plur., 700 m, 22.5.1975, *Byatt 53751 & 53752* (herb. Byatt).

Reg. Aegaea sept., Athos: *Sibthorp* (BM, specimen mixtum).

Hybrids

Throughout the range of the genus it appears that cytological barriers are insufficient to prevent hybridisation from taking place in areas where two or more taxa grow together. The extent to which such crossing occurs may depend largely on the time of flowering of the species concerned. It appears that some diploid species may give rise to hybrid swarms (Byatt 1975b), and even where chromosome numbers differ, it is possible that hybridisation may proceed for more than one generation (Byatt 1976).

Many of these apparent hybrids have characters intermediate between those of the parental species, but others are more like one parent than the other, either because backcrosses have taken place or because some characters are influenced by dominance of one or the other parental genotype.

Hybridisation is often commonest where human disturbance of habitats has brought together species originally well isolated by ecological factors such as shade tolerance. In Greece however, the most important species all grow in open situations, and to this extent may all be encouraged by human clearance and even grazing animals. The ranges of the Greek species are determined mainly by natural climatic factors and possibly also by past geological history. Plants of *Crataegus* sect. *Azaroli* tend to be spatially separated; *C. orientalis* and *C. pycnoloba* are geographically isolated and *C. heldreichii* is usually isolated from both these species altitudinally. *C. monogyna*, on the other hand, grows here and there with all the "Azaroli" at higher altitudes, where the most important barrier to hybridisation is time of flowering, since *C. monogyna* usually flowers two or three weeks before *C. orientalis* and *C. pycnoloba*, and about ten days before *C. heldreichii*.

The evidence available suggests that all these species are fairly well isolated from each other, but that in certain areas and habitats hybridisation may be more favoured by climatic and genetic factors than in others. The places where hybridisation would seem more likely are at those altitudes where two or more species can survive, i.e. *C. heldreichii* might hybridise with more mountainous species in some of its higher stations. Hybridisation may be favoured at extreme limits of ranges, both geographical and altitudinal, since here spatial isolation often breaks down and the plants are not growing in optimum conditions.

"Flora europaea" records the presence of *C. schraderana* Ledeb. in Greece. This species has characters intermediate between *C. orientalis* and *C. pentagyna* Waldst. & Kit., and according to Pojarkova (1939a) is a species of hybrid origin. It is the same as *C. tournefortii* Griseb. and the two names were published in the same year 1843. There is some doubt as to the exact month of publication of the two works containing the relevant diagnoses, but the name *C. tournefortii* appears to antedate the name *C. schraderana* by several months. The existence of this taxon in Greece is very problematical; Grisebach's description is not based on a specimen seen by him when he collected in northern Greece in 1839.

7. *Crataegus* × *albanica* Pojark. in Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk. SSSR 20: 189. 1960.

Ic.: fig. 1k.

This hybrid between *C. monogyna* and *C. orientalis* is the commonest hybrid in Greece, where the parental species grow together quite frequently on mountains at certain altitudes and intermediates, or plants with a mixture of parental characters, seem fairly common. The type specimens (*Baldacci 117*) show characters intermediate between *C. monogyna* and *C. orientalis* which are apparent in the leaf shape, petiole length, pedicel and peduncle lengths and style number. *C. orientalis* has very short petioles and compact inflorescences, in contrast with *C. monogyna* which has well-developed petioles and a lax inflorescence. The style number (2) of Baldacci's plant is also intermediate between the single style of *C. monogyna* and the (3-)4-5 of *C. orientalis*. The place where Baldacci collected *C. x albanica* in 1896 is now part of Greece. The site is quite near other areas in the Pindus range where intermediates occur in mixed populations of the two species. Baldacci himself collected another intermediate in the area, no. 47, on Mt. Mitsikeli in 1895.

Some of the characters, for example the range of fruit size and some of the leaf outlines shown, as well as the higher end of the range of altitudinal distribution, suggest that at least some of the Makedonijan plants described as *C. villosa* by Dzekov (1974) are probably conspecific with *C. x albanica*. Other of his plants, however, may be hybrids between *C. heldreichii* and *C. monogyna* as is suggested by other leaf outlines shown, the lower end of the altitudinal distribution and Dzekov's statement that *C. villosa* is commonly found growing with *C. heldreichii*.

Specimina visa

Macedonia, Imathia: in m. Vermio, 30.5.1936, *Rechinger 8829* (BM); inter Naousa et Veria, 29.6.1959, *Goulimis 19658 & 19659* (ATH). **Grevena:** inter Filippei et Samarina, 1800 m, 28.6.1937, *Balls & Gourlay 3405* (BM, K). **Pieria:** inter Katerini et Ayios Dhimitrios, 7.-11.10.1956, *Goulimis 19689* (ATH).

Thessalia, Larisa: in m. Ossa, 1100 m, 28.8.1975, *Polunin 13831* (LTR).

Trikala: in m. Oxia pr. Haliki, 9.7.1896, *Sintenis 894* (E, K).

Epirus, Ioannina: in m. Kourenta, 25.6.1896, *Baldacci 117* (BM, K; isotypi); in m. Mitsikeli, 16.6.1895, *Baldacci 47* (BM, K, PRC); in m. Avgo, 20.8.1934, *Guiol 2452* (BM).

Reg. Aegaea or., Samos: in m. Kerketefs, 1.-7.6.1955, *Goulimis 19674* (ATH).

8. *Crataegus x peloponnesiaca* Byatt, hybr. nova

Holotypus: *Polunin 12876* (LTR).

lc.: fig. 1h.

An intermediate between *C. heldreichii* and *C. pycnoloba* has been found together with both parents in the Peloponnisos, at the higher end of the altitudinal range for *C. heldreichii*. A description of this new hybrid follows:

Frutex. Cortex ramorum adultorum cinerescens, hypoderma rubro-aurantiacum, ramuli annotini villosi, brachyblasti spinis tenuibus, c. 8 mm. longis obsiti. Folia ovata, utrinque viridia, sericea, ea ramorum floriferorum ad 21 mm longa et 21 mm lata, petiolo ad 4 mm longo; folia superiora quinque vel septempartita,

sinibus angustis, basi cuneata, lobis oblongo-obovatis, apicibus paucidentatis; sinus inferiores laciniati; stipulae caducae; folia brachyblastorum eis ramorum fertilium simillima, sed saepissime septempartita, ad 27 mm longa et 22 mm lata, petiolis ad 12 mm longis. Inflorescentia compacta, c. 2.3 cm diam., pedunculis pedicellis-que sericeis, ad 8 mm longis. Hypanthium sericeum, bracteis angustis, foliaceis, glandulis paucis stipitatis instructum. Flores pauci; antherae rubrae; styli 5, apicibus excurvatis; fructus ignotus.

Floret Junio. Habitat in montibus Peloponnesiacis ad 1400 m, in regione abietina.

Hybrida inter *C. heldreichii* Boiss. & Heldr. et *C. pycnoloba* Boiss., *C. heldreichii* habitu valde similis, sed indumento sericeo, non lanato, foliis basi cuneatis, non truncatis, differt. A *C. pycnoloba* foliis viridibus non argenteis, lobis foliorum apice dentatis non integris, bracteis angustis nec ovatis differt.

Specimen visum

Peloponnesus, Achaia: Vrahni pr. Kalavrita, c. 1400 m, 10.6.1975, *Polunin* 12876 (LTR).

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