

Article

State of Crop Landraces in Arcadia (Greece) and In-Situ Conservation Potential

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Abstract: Genetic erosion of landraces is increasing worldwide, however there are still regions rich in landrace biodiversity, such as islands and mountainous isolated areas. Defining the reasons of landrace abandonment in these areas, as well as collecting and preserving landraces, is of outmost importance. In this context, the Agricultural University of Athens organized missions in 53 villages of Arcadia, a prefecture rich in floral biodiversity and variable climatic conditions and topography. The aim was to collect samples of the on-farm (in-situ) conserved annual crop landraces and record the location of perennial crop local varieties. Since traditional knowledge and practices have been playing a vital role in the survival of landraces and local varieties, information was obtained through personal interviews with locals using semi-structured questionnaires. Even though the number of accessions collected from Arcadia has been reduced (141 samples) compared to previous collections and genetic erosion is advancing dramatically for cereals and pulses, a significant number of landraces is still cultivated by the locals. The reasons of landrace abandonment were other sources of occupation than agriculture, such as public service jobs, mechanization, and commercialization of agriculture. Gastronomic and agro-tourism along with European Union trademarks and policies can support locals in landrace/local varieties in-situ conservation.

Keywords: collecting mission; conservation; conservation varieties; diversity; ex-situ; genetic material; landraces; local varieties; farmers' varieties; Peloponnese



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1. Introduction

There are many references on the importance of landraces (known also as local varieties, farmers' varieties, or conservation varieties) for their direct traditional use by humans and their value as genetic resources. According to Zeven et al. [1], the first reference regarding landraces was made in 1890s, while 20 years later the first definitions on this subject were published. Landraces are generally defined as dynamic populations of a cultivated plant species with historical origin and distinct identity and are associated with a set of farming practices and knowledge [2,3]. For centuries, crop landraces have been the genetic material used for agriculture and have played a fundamental role in the history of crops worldwide, regarding crop improvement and production [4]. Landraces have long been recognized as a source of traits for local adaptation, stress tolerance, yield stability, and nutritional quality [5]. Benlioglu and Adak [6] highlighted that plant genetic resources are the biological basis of global food security. Since cultivars often lack alleles that contribute to tolerance or resistance to biotic and abiotic stress factors, breeders use plant genetic resources (landraces and crop wild relatives) for the improvement of varieties [6]. Furthermore, as mentioned by Azzez [2], even though landraces are generally less productive

than commercial (bred/improved) cultivars, in recent years they have become important sources of genetic variability in search for genes for tolerance or resistance to biotic and abiotic stress factors and other traits. Despite the importance of the landraces, many causes have led to their genetic erosion [7]. Crop mechanization and improved high yielding cultivars have led farmers towards the abandonment of the traditional cropping practices, landrace cultivation, and on-farm conservation [3,8].

According to FAO (Food and Agriculture Organization), about 75% of local varieties have become extinct in the last 100 years [8]. It is remarkable that in some Mediterranean counties, like Albania and Italy, genetic erosion has reached more than 70% in a time interval of 50 and 30 years, respectively [9]. According to Bennett [10], wheat landraces in Greece have reduced from 80% to less than 10% during a 30-year period from 1930s to 1960s, while 97% of Greece's durum wheat landraces have been replaced by improved cultivars [11]. Landraces as genetically diverse populations can adapt to environmental and climatic changes and their wealthy gene pool can contribute to plant breeding programs [12,13]. Furthermore, they form a diverse source of food for humans and feed for animals [14]. Therefore, the necessity to record and monitor genetic resources and the degree of their genetic erosion is apparent. There are various ways of measuring genetic erosion of landraces: simple quantitative methods that relate the number of landraces to a specific region in the past and in the present; molecular methods (which are more expensive) [4,15]; or qualitative methods [16,17].

Previous studies have highlighted that isolated areas such as islands have conserved a significant number of landraces [16,17]. On the contrary, mountainous areas in Italy and Albania have presented a significant amount of landrace genetic erosion [18]. Aiming to confirm a hypothesis that isolated and mountainous areas in Greece can retain a sufficient degree of landrace diversity in the 21st century, we have chosen, as a place of study, Arcadia, a prefecture in the center of Peloponnese, an area with mostly mountainous landscape and plateaus and coastal areas in its eastern part [19]. The highest peak of the prefecture belongs to the mountain (Mt) Mainalo (1980 m) [19]. The climate of Arcadia differs between the mountainous and the coastal areas with high temperature and precipitation amplitudes [19–22]. This diverse climate and terrain result in different niches of biodiversity, enabling landraces under continuous cropping in these places to acclimatize to each microclimate and develop tolerances to various stresses [23].

The aim of this study was to (a) collect samples of conserved on farm annual crop landraces, (b) estimate the annual crop landrace genetic erosion in Arcadia, (c) record the location of still existing perennial crop landraces, (d) record traditional knowledge related to crop landraces through personal interviews, (e) access the state of landraces in relation to previous collecting missions' results in the prefecture of Arcadia, and (f) propose actions for the in situ (on farm) conservation of farmers' landraces.

2. Materials and Methods

2.1. Literature Information from Previous Missions or Databases

Information regarding the genetic material collections from Arcadia was gathered from various sources:

1. Reports and grey literature concerning plant material collecting missions in Arcadia. These reports were made by various organizations, such as:
 - Kaiser-Wilhelm-Institut für Kulturpflanzenforschung (KWIK) (1942) [24,25]; a large part of this collection has been conserved in the Gene Bank of the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) [24,25];
 - Food and Agricultural Organization (FAO) (1968) [26];
 - Germplasm Institute, Bari and the Cereal Institute of Thessaloniki (GIB and CIT) (1979) [27];
 - Vine Institute (VI) (1982/1983);
 - Fodder Crops and Pastures Institute (FCPI) (1983, 1985, 1988) [28,29];
 - Institute of Pomology (currently Department of Deciduous Fruit Trees) (1986) [30];

- National Institute of Agrobiological Sciences (NIAS) of Japan (1998) [31,32];
 - Greek Gene Bank (GGB) in 2006 [33].
2. Gene bank databases. Additional information was obtained from the website of USDA (ARS, National Germplasm Resources Laboratory, Beltsville, Maryland, GRIN 2021, [34]) and from the online platform of global Plant Genetic Resources for Food and Agriculture Genesys 2021 [35]. Other genebank databases such as European Search Catalogue for Plant Genetic Resources (EURISCO) are contained within the Genesys database [36].

2.2. Agricultural University of Athens Missions and Plant Material Collection

During 2018, 2019, and 2021, the Agricultural University of Athens (AUA) organized ten collecting missions in the region of Arcadia where plant material (mainly seeds) and information regarding landraces/local varieties was obtained. The collected plant material mainly consisted of seeds. The collectors were R. Thanopoulos, N-M. Kostouros, T. Chatzigeorgiou, and P.J. Bebeli. The expeditions took place in various villages/settlements and locations where locals and plant material donors provided useful information on the cultivation and conservation of genetic material for all the traditional crops, which included cereals, pulses, vegetables, fruit trees, and grapevine landraces/local varieties. Emphasis was given on visiting villages where collectors from previous expeditions had already collected landraces germplasm, and this information was used for comparison to the present results (Table S1).

More specifically, during the first year (2018) five missions were carried out by R. Thanopoulos and N-M. Kostouros and one by P.J. Bebeli, collecting 59 seed samples (Table S1). During the second year (2019), two missions were carried out by P.J. Bebeli, and another by R. Thanopoulos, collecting 38 samples (Table S1). Finally in 2021, the last mission was carried out by T. Chatzigeorgiou and 15 samples were collected (Table S1). In addition, 29 more seed samples were collected by Dr. Andromachi Economou, Katerina Meimeti, and the local people of Arcadia and were donated to AUA from 2012 to 2018.

2.3. Questionnaire Structure and Interview Approach

Semi-structured questionnaires were used for interviewing local people, including farmers. The questionnaire was comprised of questions regarding the annual and biennial landraces cultivated by the person interviewed or by her/his parents. Additionally, it included questions about fruit, nut tree, and grapevine local varieties. Taking permission from each local who was interviewed, we also asked

- Her/his age
- Employment status (farmer, civil servant, agronomist, etc.)
- If her parents cultivated cereals, vegetables, or legumes, etc.
- The village she/he was born
- The village she/he lives
- If she/he understands the difference between cultivars and landraces
- If she/he remembers any of the landraces she/he or her/his parents cultivated
- If she/he still cultivates any landrace, the name and morphological traits of the landrace, and its use

To avoid biased answers, the persons interviewed were asked what landraces they knew, and only if there was no answer, they were asked if they remembered any cereal, legume, vegetable, fruit or nut tree, and grapevine landrace/local variety. Each interview lasted around two hours, and often more. Finally, the local was asked if she or he had a sample of the landraces mentioned and if she or he would like to donate it to the Agricultural University of Athens (AUA) collection for conservation. The collected accessions were identified taxonomically and collected data were compiled. The seed sample was divided in two: one half was sent to the National Gene Bank and the other was stored in a refrigerator in the facilities of the Plant Breeding and Biometry laboratory (AUA).

2.4. Data Analysis

Genetic erosion was evaluated qualitatively for most of the species' groups (cereals, legumes, vegetables, and others). Because the plant germplasm collecting missions were aimed at collecting different species, and since different villages were visited, it was decided to evaluate the genetic erosion quantitatively only for cereals and legumes wherever it was possible. More specifically, genetic erosion and genetic integrity were calculated by comparing the number of landrace samples collected from the same locations between the KWIK expedition in 1942 and the recent expeditions from AUA in 2018–2021. The method used was described by Hammer et al. [18]. According to this method, by dividing the number of samples collected in 2018–2021 by the number of samples collected in 1942 and multiplying by 100, the percentage of Genetic integrity (GI%) is calculated. Genetic erosion (GE%) was calculated as $GE = 100\% - GI$.

3. Results and Discussion

3.1. Germplasm Collecting Missions

3.1.1. Kaiser-Wilhelm-Institut für Kulturpflanzenforschung Collecting Mission (1942)

In 1942, a German mission was carried out in the region of Arcadia and 176 seed samples were collected [24,25]. The largest number of samples belonged to the genera *Phaseolus* (45), followed by *Hordeum* (35), *Triticum* (34), and *Vicia* (27). In comparison, a lower number of samples was collected regarding *Lathyrus*, *Lens*, *Zea*, *Cucurbita* and *Lycopersicon esculentum* Mill., (nowadays classified as *Solanum lycopersicum* L.) (twelve, five, four, three, and two samples, respectively), and one sample from each of the genera *Avena*, *Linum*, *Cichorium*, *Cicer*, and *Cucumis* (Table 1). Cereals and legumes were the dominant group of species in the German collection, contrary to vegetables which was the largest group in our collection. This is in accordance with certain interviews where it was stated that Arcadians cultivated more vegetables after the World War II since they could irrigate their gardens. The KWIK expedition in Peloponnese was more fruitful in comparison to KWIK missions in other locations such as Crete, where a very small number of vegetables was collected (11 samples) in comparison to Peloponnese (130 samples), as well as in Yugoslavia and Albania (two and zero samples, respectively) during the same period [24].

Table 1. Collection missions made in Arcadia prefecture by different institutions from 1942 to 2021.

Group	Genus	KWIK ¹ 1942	FAO ² 1968	GIB ³ and CIT ⁴ 1979	VI ⁵ 1982/83	FCPI ⁶ 1983	FCPI 1985	FCPI 1988	NIAS ⁷ 1998	GGB ⁸ 2006	AUA ⁹ 2018–2021
Cereals, grasses	<i>Avena</i>	1		4						1	8
	<i>Dactylis</i>						4				
	<i>Festuca</i>						1				
	<i>Haynaldia</i>			2				1			
	<i>Hordeum</i>	35		6				1	2	1	7
	<i>Secale</i>			1							
	<i>Triticum</i>	34	19	16				1	4	6	34
	<i>Zea</i>	4								7	17
	<i>Aegilops</i>			3				8		1	
Pulses and other legumes	<i>Lolium</i>			3			3				
	Subtotal	74	19	35			8	11	6	16	66
	<i>Astragalus</i>									1	
	<i>Cicer</i>	1				13				2	1
	<i>Lens</i>	5		1		5					1
	<i>Lathyrus</i>	12								1	
	<i>Medicago</i>									8	
	<i>Phaseolus</i>	45		2			3			25	25
	<i>Pisum</i>	4									
Subtotal	<i>Trifolium</i>			1			3			5	
	<i>Vicia</i>	27		12						3	4
	<i>Vigna</i>									2	3
	Subtotal	94		16		18	6			47	34

Table 1. Cont.

Group	Genus	KWIK ¹ 1942	FAO ² 1968	GIB ³ and CIT ⁴ 1979	VI ⁵ 1982/83	FCPI ⁶ 1983	FCPI 1985	FCPI 1988	NIAS ⁷ 1998	GGB ⁸ 2006	AUA ⁹ 2018–2021
Vegetables	<i>Abelmoschus</i>									3	2
	<i>Allium</i>										1
	<i>Amaranthus</i>										1
	<i>Apium</i>									2	
	<i>Beta</i>									2	
	<i>Brassica</i>									3	1
	<i>Capsicum</i>									1	3
	<i>Cichorium</i>	1								4	
	<i>Citrullus</i>									4	
	<i>Cucumis</i>	1								10	3
	<i>Cucurbita</i>	3								10	8
	<i>Cynara</i>										1
	<i>Lactuca</i>									3	1
	<i>Lagenaria</i>									1	
	<i>Raphanus</i>									1	
Other species	<i>Solanum</i>	2								7	15
	<i>Spinacia</i>									1	
	Subtotal	7								52	36
	<i>Anethum</i>									1	
	<i>Calamintha</i>									1	
	<i>Helianthus</i>									2	
	<i>Lavandula</i>									1	
	<i>Linum</i>	1									
	<i>Origanum</i>									1	1
	<i>Ocimum</i>									2	
	<i>Petroselinum</i>									2	
	<i>Sideritis</i>										2
	<i>Vitis</i>				42						
	<i>Olea</i>										1
	<i>Juglans</i>										1
Subtotal		1			42					10	5
Total		176	19	51	42	18	14	11	6	125	141

¹ Kaiser-Wilhelm-Institut für Kulturpflanzenforschung, ² Food and Agriculture Organization, ³ Genebank Institute of Bari, ⁴ Cereal Institute of Thessaloniki, ⁵ Vine Institute, ⁶ Fodder Crops and Pastures Institute, ⁷ National Institute of Agrobiological Sciences (NIAS) of Japan, ⁸ Greek Gene Bank, ⁹ Agricultural University of Athens.

3.1.2. Collecting Mission Organized by Food and Agricultural Organization (FAO) (1968)

This mission was dedicated exclusively to wheat and was carried out in 1968 by Erna Bennett. She collected 19 samples belonging to *Triticum* (Table 1) from 14 villages located in Arcadia (Daras, Dimitsana, Elliniko, Kaloneri, Kapsas, Kerastaris, Limni, Megalopoli, Nymfasia, PalaioPyrgos, Psari, Soulos, Thanas, Zatonou) and she emphasized that the genetic erosion of this genus was increasing rapidly [26], which is true compared to the German expedition that took place 26 years earlier in 1942 (see Section 3.1.1).

3.1.3. Germplasm Institute, Bari (GIB), and the Cereal Institute of Thessaloniki (CIT) Collecting Mission (1979)

During the Germplasm Institute, Bari (GIB), and Cereal Institute of Thessaloniki (CIT) collecting mission in 1979, 51 samples were collected from 15 villages (Dafni, Daras, Davia, Kalyvia, Karkalou, Karytaina, Lagadia, Levidi, Megalopoli, Pania, Stemnitsa, Tripoli, Vlacherna, Vytina, Zarouchla). Most of the samples collected were cereals and other cereal wild relatives (69%) [27] (Table 1) as also reported by the Erna Bennet [26]. This was expected, as the aim of the mission was to collect wild or cultivated (landraces) germplasm of wheat and other cereals, as well as legumes [27].

3.1.4. Vine Institute (VI) (1982/1983)

The Vine Institute (VI) organized a mission to collect grapevine local varieties in Greece. Eleven villages (Agios Georgios, Drakovouni, Kamenitsa, Markou, Mavrogianis, Nymfasia, Rafti, Sella Pafrafiou, Skortsinos, Theoktiston, Zygovitsi) were visited, 42 grapevine local varieties were recorded, and samples-material was collected from each of them.

3.1.5. Fodder Crops and Pastures Institute (FCPI) (1983, 1985, 1988)

In 1983, a mission with the aim to collect seeds of legume landraces was organized by the FCPI in Macedonia (Greece) and in Peloponnese [28]. Thirteen villages were visited in Arcadia (Agios Petros, Agios Sostis, Agios Ioannis, Fouskati, Kandila, Lafka, Nestani, Palaiopyrgos, Partheni, Paradissia, Psili Vrisi, Skotini, Soulandi, Vyziki) and Skotini Argolidas village near the borders of Arcadia and 18 legumes samples were collected (Table 1) [28]. All samples in this mission were legume (mainly pulses), with only a small number of samples being collected in each village.

In 1985, another mission in Arcadia was organized by FCPI and its results included samples from eight villages (Ano Davia, Artemisio, Doriza, Leventi, Levidi, Panagitsa, Saga, Tripoli). More specifically, the grasses collected were four *Dactylis glomerata* accessions, one *Festuca arundinacea* and three *Lolium perenne* accessions, while the legume pulses were three *Phaseolus vulgaris* and the legume forages were three *Trifolium alexandrinum* samples [29].

In 1988, nine crop wild relatives and two landrace samples were collected by FCPI from seven villages (Arcadiko Chorio, Chimerini Meligou, Kerasitsa, Mario, Peleta, Plaka, Poulithra), more specifically eight samples of the genus *Aegilops* and one of each of the genera *Haynaldia*, *Hordeum*, and *Triticum* (Table 1).

3.1.6. Institute of Pomology (1986)

In 1986, researchers from the former Institute of Pomology led an expedition in locations sensitive to genetic erosion. In this mission, nine villages were visited in Arcadia, aiming to collect local varieties and wild relatives of *Prunus* species. Among other places in Peloponnese, the following villages in Arcadia were visited: Eleochoi, Kynouria, Rizes, Vlachokerasia of Mandinia, Partheni, Steno, Agiorgtika and Vytina. A total of 48 accessions samples were collected, more specifically five *Prunus amygdalus*, one *P. persica*, six *P. armeniaca*, twenty *P. avium*, eight *P. cerasus*, six *P. domestica*, and two *P. mahaleb* [30].

3.1.7. National Institute of Agrobiological Sciences (NIAS) of Japan (1998)

During a Japanese mission that also took place in Arcadia in 1998, six samples were collected (from four locations near Tripoli, Levidi, Orchomenos, and Tzivas), out of which four belonged to genus *Triticum* and two to genus *Hordeum* [31,32]. As well as in previous missions in Arcadia [26,27], the NIAS mission aimed to collect cereal germplasm.

3.1.8. The Collection of the Greek Gene Bank (GGB) (2006)

To access the landrace biodiversity status of the Peloponnese prefecture (including Arcadia), the GGB organized a collecting mission in 2006 and more than 120 (mainly landraces and wild plants) samples from nine villages (Alonistaina, Artemisio, Dimitsana, Kapsia formerly known as Kapsas, Kato Davia, Kosmas, Platana, Valtasiniko, Vytina) were collected [33]. The GGB collection included 15 cereal landrace accessions (wheat, maize, barley), one cereal crop-wild relative (*Aegilops triaristata*), and 52 vegetable landraces belonging mainly to the genera *Cucumis*, *Cucurbita*, and *Solanum lycopersicum* L. [33]. Additionally, 47 legume accessions, including species from the genera *Astragalus*, *Cicer*, *Lathyrus*, *Medicago*, *Phaseolus*, *Trifolium*, *Vicia*, and *Vigna* and ten medicinal, aromatic or other plant species samples (e.g., *Anethum* sp., *Calamintha* sp., *Helianthus* sp., *Lavandula* sp., *Ocimum* sp., *Origanum* sp.), were gathered (Table 1) [33].

3.1.9. Databases

The USDA (ARS, National Germplasm Resources Laboratory, Beltsville, Maryland, GRIN) collection conserves 30 accessions of cereals and legumes from Arcadia (Table 2) [34]. In Genesys, which is an online platform containing information about Plant Genetic Resources for Food and Agriculture (PGRFA) conserved in genebanks worldwide, 185 accessions from Arcadia were found [35]. Fifty-eight of the Genesys accessions belong to cereals and grasses, 77 to pulses and other legumes, and seven to vegetables (Table 2). A total number of 58 out of 74 cereal accessions and 77 out of 94 pulses collected from Arcadia since 1942 [24,25] have been conserved in gene banks according to the Genesys platform [35]. However, the number of landrace samples in GRIN and/or Genesys may contain duplicates of the same material that is stored in IPK from collection in 1942 [25]. What is greatly lacking from the gene banks is genetic material from vegetables originating from Arcadia. This was expected because previous collectors did not have vegetable collection as a goal and earlier multi-species collections did not find vegetable species on a large scale. Initially, local farmers reported landraces, either that were cultivated to be sold (and contribute to his/her income) or those that were cultivated on a small scale in gardens or orchards for their own consumption. Therefore, it was important for the interviewers to highlight this issue during an interview.

Table 2. Collection of plant species of Arcadia extracted by databases.

Group	Scientific Name	Genesys	GRIN
Cereals, grasses	<i>Aegilops comosa</i> Sm.	3	
	<i>Aegilops lorentii</i> Hochst.	2	
	<i>Aegilops triuncialis</i> L.	1	
	<i>Avena sativa</i> L.		1
	<i>Dactylis glomerata</i> L.	4	1
	<i>Festuca arundinacea</i> Schred.	1	
	<i>Haynaldia villosa</i> (L.) Schur.	1	
	<i>Hordeum bulbosum</i> L.	1	
	<i>Hordeum vulgare</i> L.		26
	<i>Hyparrhenia hirta</i> (L.) Stapf.		1
	<i>Lolium perenne</i> L.	5	
	<i>Lolium</i> sp.	1	
	<i>Triticum aestivum</i> L.	3	
	<i>Triticum durum</i> Desf.	2	
	<i>Zea mays</i> L.	34	
Subtotal		58	29
Pulses and other legumes	<i>Cicer arietinum</i> L.	11	
	<i>Lathyrus sativus</i> L.	4	
	<i>Lens culinaris</i> Medik.	14	1
	<i>Lens esculenta</i> Moench.	1	
	<i>Medicago coronata</i> (L.) Bartal.	1	
	<i>Medicago orbicularis</i> (L.) Bartal.	3	
	<i>Medicago</i> sp.	4	
	<i>Medicago truncatula</i> Gaertn.	2	
	<i>Phaseolus vulgaris</i> L.	3	
	<i>Trifolium alexandrinum</i> L.	3	
	<i>Trifolium repens</i> L.	3	
	<i>Vicia ervilia</i> (L.) Willd.	4	
	<i>Vicia faba</i> L.	8	
	<i>Vicia sativa</i> L.	13	
	<i>Vicia sativa</i> L. subsp. <i>sativa</i>	2	
	<i>Vicia sativa</i> L. subsp. <i>sativa</i> var. <i>obovata</i> Ser.	1	
Subtotal		77	1

Table 2. Cont.

Group	Scientific Name	Genesys	GRIN
Vegetables and wild edibles	<i>Brassica cretica</i> Lam.	4	
	<i>Lactuca serriola</i> L.	2	
	<i>Brassica cretica</i> Lam. subsp. <i>laconica</i> Gustafs. and Snogerup.	1	
		7	0
Subtotal			
Grapevines	<i>Vitis vinifera</i> L.	43	
Subtotal		43	0
Total		185	30

3.1.10. Collection by AUA Missions in Relation to Previous Expeditions

In the collecting missions carried out during 2018 to 2021, 53 villages were visited. Seed samples were collected in 34 of the villages, while information regarding crop landraces/perennial local varieties was recorded in all villages (Figure 1, Table 3).

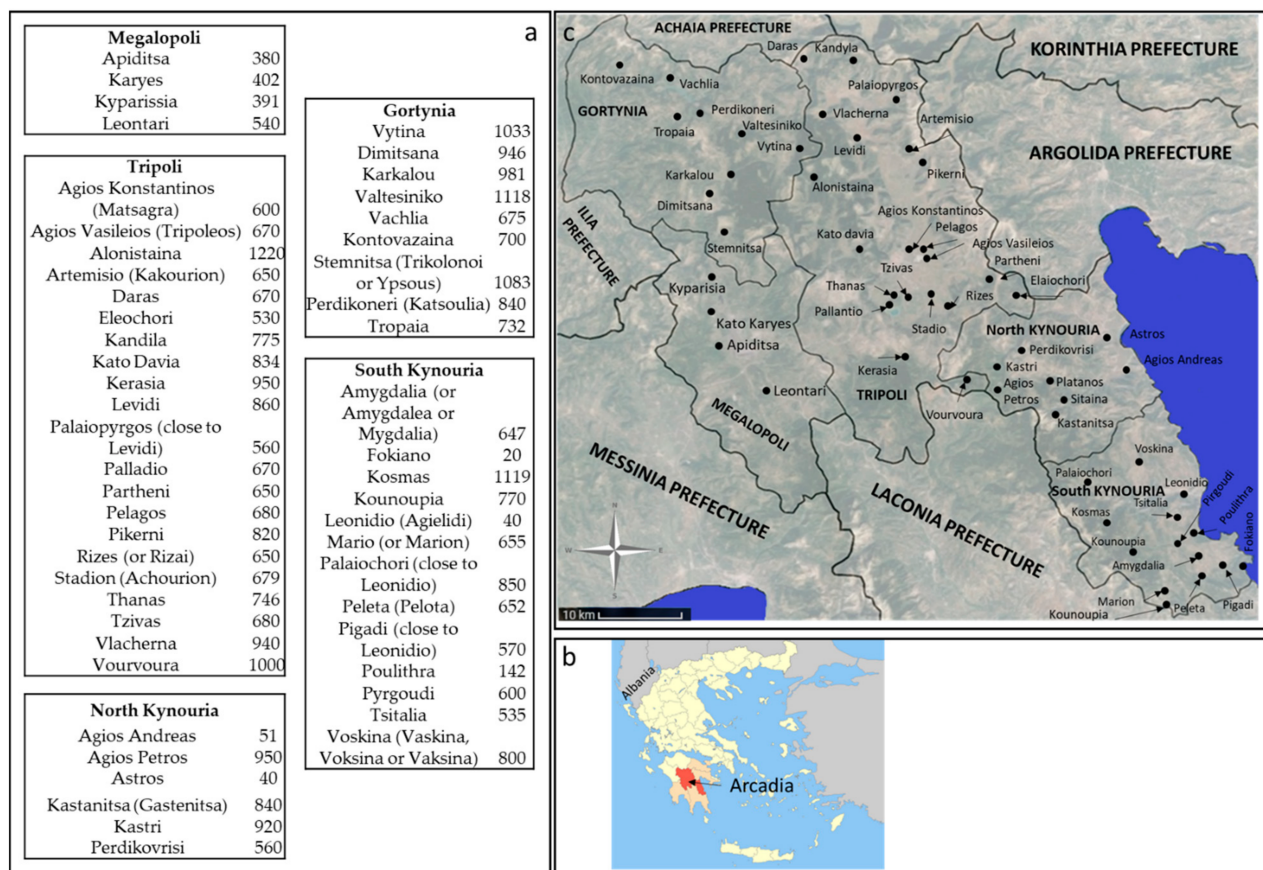


Figure 1. (a) Visited villages with their altitude in m (above sea level), (b) location of Arcadia prefecture in Greece, (c) visited village position in Arcadia.

Table 3. Landraces; aromatic, medicinal, and wild edible plants; and perennial local varieties reported in interviews and collected accessions during the AUA expeditions in Arcadia.

Species	Botanical Family	Common Name English, Greek	Samples	Villages Cited ¹
Pulses and other legumes				
<i>Cicer arietinum</i> L.	Fabaceae	Chickpea, Πεβύθι	1	Agiorgitika, Agios Konstantinos, Agios Vasileios, Agriakona, Artemisio, Chrysovitsi, Davia, Kapsas, Levidi, Leontari, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Pelagos, Piana, Pikerni, Rizes, Stemnitsa, Tzivas, Valtasiniko, Vlacherna, Vytina
<i>Lathyrus</i> spp.	Fabaceae	Vetchlings, Λαθούρια		Agiorgitika, Agios Konstantinos, Agriakona, Apiditsa, Artemisio, Davia, Kandila, Kapsas, Leontari, Levidi, Limni, Magoulia, Makri, Nymfasia, Partheni, Perdikoneri, Pikerni, Rizes, Stemnitsa, Tropaia, Tzivas, Valtasiniko, Vlacherna, Vytina, Zevgolateio
<i>Lens culinaris</i> Medik.	Fabaceae	Lentil, Φακί	1	Agriakona, Artemisio, Chrysovitsi, Davia, Kapsas, Kerasia, Leontari, Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Perdikoneri, Piana, Pikerni, Rizes, Stemnitsa, Tropaia, Tzivas, Valtasiniko, Vlacherna, Vytina, Daras
<i>Lupinus albus</i> L.	Fabaceae	White lupin, Λούπινο λευκό		Agriakona, Kapsas, Leontari, Makri, Rizes, Stemnitsa, Tzivas
<i>Lupinus luteus</i> L.	Fabaceae	Yellow lupin, Λούπινο κίτρινο		Leontari
<i>Medicago</i> spp.	Fabaceae	Alfalfa, Μηδική		Agios Vasileios, Artemisio, Karkalou, Nymfasia, Palladio, Partheni
<i>Phaseolus coccineus</i> L.	Fabaceae	Runner bean, Γήραντες—ελέφαντες		Agriakona, Tzivas
<i>Phaseolus vulgaris</i> L.	Fabaceae	Common bean, Φασόλι	25	Agios Konstantinos, Agios Vasileios, Agiorgitika, Alonistaina, Apiditsa, Artemisio, Davia, Kapsas, Karkalou, Kastanitsa, Kerasia, Leonidio, Levidi, Limni, Magoulia, Makri, Nymfasia, Palaiochori, Palladio, Perdikoneri, Partheni, Piana, Pikerni, Platanos, Rizes, Stemnitsa, Stadio, Tzivas, Valtasiniko, Vlacherna, Vytina, Zevgolateio
<i>Pisum sativum</i> L.	Fabaceae	Pea, Αρακάς / Μπιζέλι		Agiorgitika, Agios Konstantinos, Agriakona, Alonistaina, Chrysovitsi, Davia, Levidi, Limni, Magoulia, Nymfasia, Palladio, Partheni, Rizes, Stemnitsa, Tropaia, Tzivas, Valtasiniko, Vlacherna
<i>Vicia faba</i> L.	Fabaceae	Faba bean, Κουκί	4	Agios Konstantinos, Agriakona, Artemisio, Davia, Kapsas, Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Piana, Pikerni, Rizes, Stemnitsa, Thanas, Tzivas, Valtasiniko, Vlacherna, Zevgolateio
<i>Vicia</i> spp.	Fabaceae	Vetch, Βίκος		Agios Vasileios, Agriakona, Alonistaina, Artemisio, Chrysovitsi, Davia, Kapsas, Karkalou, Kerasia, Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Pelagos, Perdikoneri, Piana, Rizes, Stemnitsa, Tropaia, Tzivas, Valtasiniko, Vlacherna, Vytina
<i>Vicia ervilia</i> (L.) Willd.	Fabaceae	Ervil, ρόβι		Agios Vasileios, Pelagos, Perdikoneri

Table 3. Cont.

Species	Botanical Family	Common Name English, Greek	Samples	Villages Cited ¹
<i>Vigna radiata</i> (L.) R. Wilczek	Fabaceae	Mung bean, Ροβίτσα, ψιλοφάσουλο		Agios Konstantinos, Agriakona, Chrysovitsi, Levidi, Limni, Nymfasia, Palladio, Partheni, Pikerni, Rizes, Tropaia, Tzivas, Zevgolateio
<i>Vigna unguiculata</i> (L.) Walp.	Fabaceae	Cowpea, Μαυρομάτικο	3	Agios Konstantinos, Agriakona, Artemisio, Chrysovitsi, Kapsas, Kerasia, Levidi, <i>Leontari</i> , Limni, Makri, Nymfasia, Palladio, Partheni, Perdikoneri, Pikerni, Rizes, <i>Stadio</i> , Stemnitsa, Tzivas, Valtesiniko, Vlacherna
Subtotal			34	
Cereals				
<i>Avena byzantina</i> Koch.	Poaceae	Oat, Βρώμη	6	Agiorgitika, Agios Konstantinos, Agriakona, Alonistaina, Apiditsa, Artemisio, Chrysovitsi, Davia, Kapsas, Kerasia, <i>Levidi</i> , Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Pelagos, Perdikoneri, Piana, Pikerni, Rizes, <i>Stemnitsa</i> , <i>Tzivas</i> , Valtesiniko, Vlacherna, Vytina, Zevgolateio
<i>Avena sativa</i> L.	Poaceae	Oat, Βρώμη	2	<i>Artemisio</i> ² , Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Pelagos, Perdikoneri, Piana, Pikerni, Rizes, <i>Stemnitsa</i> , <i>Tzivas</i> ³ , Valtesiniko, Vlacherna, Vytina, Zevgolateio
<i>Hordeum vulgare</i> L.	Poaceae	Barley, Κριθάρι	7	Agiorgitika, Agios Konstantinos, Agios Vasileios, Agriakona, Alonistaina, Apiditsa, <i>Artemisio</i> , Chrysovitsi, Davia, Kandila, Kapsas, Karkalou, Kerasia, <i>Levidi</i> , Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, <i>Pelagos</i> , Perdikoneri, Piana, Pikerni, Rizes, <i>Stemnitsa</i> , Tropaia, <i>Tzivas</i> , Valtesiniko, Vlacherna, Vytina, Zevgolateio
<i>Secale cereale</i> L.	Poaceae	Rye, Σίκαλη		Agiorgitika, Agios Konstantinos, Agriakona, Artemisio, Chrysovitsi, Davia, Kandila, Kapsas, Leontari, Limni, Makri, Nymfasia, Palladio, Partheni, Piana, Pikerni, Rizes, <i>Stemnitsa</i> , Tzivas, Valtesiniko, Vlacherna, Vytina
<i>Sorghum bicolor</i> (L.) Moench	Poaceae	Sorghum, Σόργο		Agriakona, Tzivas
<i>Triticum</i> spp.	Poaceae	Wheat, Σιτάρι	34	Agiorgitika, Agios Konstantinos, Agios Vasileios, Agriakona, Alonistaina, Amygdalia, Apiditsa, Artemisio, Chrysovitsi, Daras, <i>Davia</i> , <i>Kandila</i> , Kapsas, Karkalou, Kato Davia, Kerasia, <i>Leonidio</i> , Leontari, <i>Levidi</i> , Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Pelagos, Perdikoneri, Piana, Pikerni, Rizes, <i>Stemnitsa</i> , Tropaia, Tzivas, <i>Valtesiniko</i> , <i>Vaskina</i> , Vlacherna, Vytina, Zevgolateio
<i>Zea mays</i> L.	Poaceae	Maize, Καλαμπόκι	17	Agios Konstantinos, Agios Vasileios, Agriakona, Apiditsa, Alonistaina, Artemisio, Chrysovitsi, Davia, Dimitsana, Kandila, Kapsas, <i>Karkalou</i> , Kontovazaina, Leonidio, <i>Leontari</i> , Levidi, Limni, Makri, Nymfasia, <i>Palaiochori</i> , Partheni, Pelagos, Perdikoneri, Pikerni, Rizes, <i>Stadio</i> , <i>Stemnitsa</i> , Tzivas, <i>Valtesiniko</i> , Vlacherna, Vytina, Zevgolateio
Subtotal			66	

Table 3. Cont.

Species	Botanical Family	Common Name English, Greek	Samples	Villages Cited ¹
Industrial crops				
<i>Cannabis</i> spp.	Cannabaceae	Cannabis, Κάναβη		Artemisio, Kapsas, Leontari, Limni, Makri, Partheni, Stemnitsa
<i>Nicotiana tabacum</i> L.	Solanaceae	Tobacco, Καπνός		Agriakona, Artemisio, Davia, Kapsas, Leontari, Makri, Pikerni, Tzivas
<i>Sesamum indicum</i> L.	Pedaliaceae	Sesame, Σουσάμι		Perdikoneri
<i>Sinapis</i> L.	Brassicaceae	Mustard, Σινάπι		Perdikoneri
Subtotal				
Vegetables				
<i>Abelmoschus esculentus</i> (L.)	Malvaceae	Ladies “fingers”/okra, Μπάμια	2	Agiorgitika, Agriakona, Artemisio, Kapsas, <i>Kosmas</i> , Limni, Makri, Palladio, Partheni, Platanos, Rizes, Tzivas, Vlacherna
<i>Allium ampeloprasum</i> L.	Amaryllidaceae	Leek, Πράσο		Limni, Palladio, Pikerni, Tzivas, Vlacherna
<i>Allium cepa</i> L.	Amaryllidaceae	Onion, Κρεμμύδι		Agiorgitika, Agios Konstantinos, Agios Vasileios, Agriakona, Artemisio, Chrysovisi, Kapsas, Karkalou, Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Pikerni, Rizes, Stemnitsa, Tzivas, Valtasiniko, Zevgolateio
<i>Allium sativum</i> L.	Amaryllidaceae	Garlic, Σκόρδο	1	Agiorgitika, Agios Konstantinos, Agriakona, Artemisio, Chrysovisi, Kapsas, Karkalou, Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, <i>Pikerni</i> , Rizes, Stemnitsa, Tzivas, Valtasiniko, Vlacherna, Zevgolateio
<i>Amaranthus blitum</i> L.	Amaryllidaceae	Purple amaranth, Βλίτο	1	<i>Kosmas</i>
<i>Anethum graveolens</i> L.	Apiaceae	Dill, Άνηθος		Nymfasia
<i>Apium graveolens</i> L.	Apiaceae	Celery, Σέλινο		Agriakona, Kapsas, Nymfasia, Pikerni
<i>Beta vulgaris</i> L. subsp. <i>vulgaris</i> var. <i>conditiva</i>	Chenopodiaceae	Beetroot, Παντζάρι		Agios Vasilgeios, Artemisio, Limni, Palladio, Pikerni, Rizes, Tzivas
<i>Brassica oleracea</i> L.	Brassicaceae	Cabbage, Λάχανο	1	Agiorgitika, Agios Konstantinos, Agios Vasileios Agriakona, Artemisio, Davia, Kapsas, <i>Kastri</i> , Kerasia, Leontari, Magoulia, Makri, Nymfasia, Palaiochori, Palladio, Partheni, Perdikoneri, Pikerni, Rizes, Stemnitsa, Tzivas, Vahlia, Valtasiniko, Vlacherna
<i>Brassica oleracea</i> var. <i>botrytis</i>	Brassicaceae	Cauliflower, Κουνουπίδι		Agriakona, Artemisio, Kapsas, Palladio, Partheni, Pikerni, Rizes, Tzivas
<i>Brassica oleracea</i> var. <i>italica</i>	Brassicaceae	Broccoli, Μπρόκολο		Pikerni
<i>Capsicum annuum</i> L.	Solanaceae	Pepper, Πιπεριά	3	Agiorgitika, Artemisio, Kapsas, Makri, Palladio, Pikerni, Towards <i>Thanas</i> , Tropaia, Agriakona, Magoulia, Rizes, Vourvoura
<i>Cichorium intybus</i> L.	Asteraceae	Chicory, Ραδίκι		Agios, Vasileios, Karkalou, Nymfasia
<i>Citrullus lanatus</i> (Thunb.) Matsum. and Nakai	Cucurbitaceae	Watermelon, Καρπούζι		Artemisio, Kapsas, Leontari, Limni, Magoulia, Makri, Nymfasia, Partheni, Pikerni, Rizes, Tzivas
<i>Cucumis melo</i> L.	Cucurbitaceae	Melon, Πεπόνι	2	Agiorgitika, Agriakona, Artemisio, Kapsas, Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Pikerni, Rizes, Tzivas, Vlacherna

Table 3. Cont.

Species	Botanical Family	Common Name English, Greek	Samples	Villages Cited ¹
<i>Cucumis sativus</i> L.	Cucurbitaceae	Cucumber, Αγγούρι	1	Agiorgitika, Agios Konstantinos, Agios Vasileios, Agriakona, Artemisio, Kapsas, Leontari, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, <i>Platanos</i> , Pikerni, Rizes, Tzivas, Valtesiniko, Vlacherna
<i>Cucurbita moschata</i> Duchesne ex Poir.	Cucurbitaceae	Pumpkin, Κολοκύθα μοσχάτη	7	Agios Vasileios, Agriakona, Leontari, Palladio, Partheni, Perdikoneri, Pikerni, Karkalou, Rizes, <i>Towards Thanas</i> , Tzivas,
<i>Cucurbita pepo</i> L.	Cucurbitaceae	Zucchini, Κολοκυθάκι	1	Agiorgitika, Agios Konstantinos, Agios Vasileios, Agriakona, Artemisio, Davia, Kapsas, Karkalou, <i>Kastri</i> , Kerasia, Kosmas, Levidi, Limni, Magoulia, Makri, Nymfasia, Palaiochori, Palladio, Partheni, Perdikoneri, Pikerni, Stemnitsa, Towards Thanas, Tzivas, Valtesiniko, Vlacherna, Zevgolateio
<i>Cynara cardunculus</i> L. var. <i>scolymus</i>	Asteraceae	Artichoke, Αγκινάρα	1	Agriakona, <i>Kosmas</i> , Partheni, Pikerni, Tzivas
<i>Daucus carota</i> subsp. <i>sativus</i> (Hoffm.) Schübl. and G. Martens	Apiaceae	Carrot, Καρότο		Palladio, Partheni, Tzivas
<i>Eruca sativa</i> Mill.	Brassicaceae	Rocket, Ρόκα		Nymfasia
<i>Foeniculum vulgare</i> Mill.	Apiaceae	Fennel, Μάραθο		Nymfasia
<i>Lactuca sativa</i> L.	Asteraceae	Lettuce, Μαρούλι	1	Agriakona, Artemisio, Chrysovitsi, Kapsas, Karkalou, <i>Kosmas</i> , Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Perdikoneri, Pikerni, Stemnitsa, Tzivas, Valtesiniko, Vlacherna
<i>Petroselinum crispum</i> (Mill.)	Apiaceae	Parsley, Μάϊντανός		Chrysovitsi, Nymfasia, Pikerni
<i>Raphanus sativus</i> (L.) Domin	Brassicaceae	Radish, Ραδίκι		Makri
<i>Solanum lycopersicum</i> L.	Solanaceae	Tomato, Τομάτα	13	Agios Vasileios, Agiorgitika, Agios Konstantinos, Agriakona, Apiditsa, Artemisio, Kapsas, <i>Kastri</i> , Kerasia, Kosmas, Leonidio, Leontari, Levidi, Limni, Magoulia, Makri, Nymfasia, Palladio, Partheni, Perdikoneri, Pikerni, <i>Platanos</i> , Rizes, Tropaia, Tzivas, Valtesiniko, Vlacherna, Zevgolateio
<i>Solanum melongena</i> L.	Solanaceae	Eggplant, Μελιτζάνα	2	Agriakona, Apiditsa, Artemisio, Chrysovitsi, Kapsas, Leontari, Magoulia, Makri, Nymfasia, Palladio, Partheni, <i>Platanos</i> , Tropaia, Tzivas, Valtesiniko, Vlacherna
<i>Spinacia oleracea</i> L.	Amaranthaceae	Spinach, Σπανάκι		Pikerni
Subtotal			36	
Aromatic, medicinal, edible herbs and industrial				
<i>Anthriscus cerefolium</i> L. (syn <i>Scandix cerefolium</i> L.)	Umbelliferae	Chervil, Μυρώνια		Karkalou, Leontari
<i>Calamintha</i> sp. Mill.	Lamiaceae	Calamints, Καλαμίνθη		Agriakona, Chrysovitsi, Limni, Makri, Nymfasia, Partheni, Tzivas
<i>Hypericum perforatum</i> L.	Hypericaceae	St John's-wort, Σπαθόχορτο		Karkalou, Leontari

Table 3. Cont.

Species	Botanical Family	Common Name English, Greek	Samples	Villages Cited ¹
<i>Lavandula</i> sp.	Lamiaceae	Levander, Λεβάντα		Leontari
<i>Linum usitatissimum</i> L.	Linaceae	Flax, Λινάρι		Agriakona, Leontari, Tzivas
<i>Mentha pulegium</i> L.	Lamiaceae	Pennyroyal, Φλισκούνη		Karkalou
<i>Mentha</i> sp.	Lamiaceae	Spear-mind, Μέντα		Karkalou
<i>Ocimum basilicum</i> L.	Lamiaceae	Basil, Βασιλικός		Agriakona, Limni, Nymfasia, Partheni
<i>Origanum majorana</i> L.	Lamiaceae	Marjoram, Ματζουράνα		Nymfasia
<i>Origanum vulgare</i> ssp. <i>hirtum</i> L.	Lamiaceae	Oregano, Ρίγανη	1	Agriakona, Karkalou, Leontari, Tzivas, Vaskina
<i>Rosmarinus officinalis</i> L.	Lamiaceae	Rosemary, Δενδρολίβανο		Karkalou
<i>Rumex</i> sp.	Polygonaceae	Sorrel, Λάπαθο		Limni, Nymfasia
<i>Sideritis</i> sp.	Lamiaceae	Mountain Tea, Τσάι του βουνού	2	Karkalou, Vaskina
<i>Sonchus</i> sp.	Asteraceae	Common sowthistle, Ζωχός		Karkalou, Leontari
<i>Taraxacum</i> sp.	Asteraceae	Dandelion, Πικραλίδες		Leontari
<i>Tordylium apulum</i> L.	Apiaceae	Mediterranean hartwort, Κανκαλήθρα		Karkalou, Leontari, Nymfasia
Subtotal			3	
Fruit, nut trees, and grapevines				
<i>Castanea sativa</i> L. Mill	Fagaceae	Chestnut, Καστανιά		Karkalou, Kerasia
<i>Citrus sinensis</i> L.	Rutaceae	Orange tree, Πορτοκαλιά		Agiorgitika, Agriakona, Alonistaina, Artemisio, Chrysovitsi, Davia, Kapsas, Levidi, Limni, Makri, Nymfasia, Palladio, Partheni, Piana, Pikerni, Rizes, Stemnitsa, Tzivas, Vlacherna
<i>Cydonia oblonga</i> L.	Rosaceae	Quince, Κυδωνιά		Agiorgitika, Agriakona, Apiditsa, Alonistaina, Artemisio, Chrysovitsi, Davia, Kapsas, Levidi, Leontari, Limni, Nymfasia, Palladio, Partheni, Perdikoneri, Piana, Rizes, Stemnitsa, Thanas, Tzivas
<i>Ficus carica</i> L.	Moraceae	Fig tree, Συκιά		Karkalou
<i>Juglans regia</i> L.	Juglandaceae	Walnut, Καρυδιά	1	Agiorgitika, Agios Vasileios, Agriakona, Alonistaina, Artemisio, Chrysovitsi, Davia, Kapsas, Karkalou, Kerasia, Levidi, Limni, Nymfasia, Palladio, Partheni, Pelagos, Piana, Rizes, Stemnitsa, Thanas, Tzivas, Valtasiniko
<i>Malus domestica</i> Borkh.	Rosaceae	Apple tree, Μηλιά		Leontari, Perdikoneri
<i>Olea europaea</i> L.	Oleaceae	Olive tree, Ελιά	1	Agiorgitika, Agios Konstantinos, Agriakona, Amygdalia,
<i>Prunus amygdalus</i> Batsch	Rosaceae	Almond tree, Αμυγδαλιά		Artemisio, Davia, Levidi, Limni, Makri, Nymfasia, Palladio, Partheni, Piana, Pikerni, Rizes, Stemnitsa, Tzivas, Valtasiniko, Vlacherna

Table 3. Cont.

Species	Botanical Family	Common Name English, Greek	Samples	Villages Cited ¹
<i>Prunus avium</i> L.	Rosaceae	Cherry tree, Κερασιά, Πετροκερασιά		Agios Vasileios, Agiorgitika, Artemisio, Davia, Kapsas, Karkalou, Kerasia, Levidi, Limni, Makri, Nymfasia, Palladio, Partheni, Pikerni, Rizes, Stemnitsa, Tzivas, Valtesiniko, Vlacherna
<i>Prunus cerasifera</i> L.	Rosaceae	Cherry plum tree, Κορομηλιά, Μπουρνελιά		Alonistaina, Chrysovitsi, Davia, Kapsas, Leontari, Levidi, Limni, Makri, Nymfasia, Partheni, Perdikoneri, Piana, Pikerni, Rizes, Stemnitsa, Tzivas, Vlacherna
<i>Prunus cerasus</i> L.	Rosaceae	Sour cherry tree, Βυσσινιά		Agios Vasileios, Alonistaina, Davia, Kapsas, Levidi, Limni, Makri, Nymfasia, Palladio, Partheni, Piana, Rizes, Stemnitsa, Tzivas, Valtesiniko, Vlacherna
<i>Prunus domestica</i> L.	Rosaceae	European plum, Δαμασκηλιά		Limni, Makri, Palladio, Stemnitsa, Valtesiniko
<i>Prunus persica</i> L.	Rosaceae	Peach tree, Ροδακινιά		Agriakona, Karkalou, Makri, Nymfasia, Palladio, Valtesiniko
<i>Punica granatum</i> L.	Punicaceae	Pomegranate tree, Ροδιά		Agriakona, Artemisio, Piana, Pikerni, Rizes, Stemnitsa
<i>Pyrus communis</i> L.	Rosaceae	Pear tree, Αχλαδιά		Agiorgitika, Agriakona, Alonistaina, Apiditsa, Artemisio, Chrysovitsi, Davia, Kapsas, Karkalou, Leontari, Levidi, Limni, Makri, Nymfasia, Palladio, Partheni, Perdikoneri, Piana, Pikerni, Rizes, Stemnitsa, Tzivas, Valtesiniko, Vlacherna
<i>Vitis vinifera</i> L.	Vitaceae	Grape vine, Αμπέλι		Agriakona, Agios Konstantinos, Agios Vasileios, Agriakona, Apiditsa, Artemisio, Chrysovitsi, Davia, Kapsas, Kerasia, Leontari, Levidi, Limni, Limni Ladona, Makri, Nymfasia, Palaioipyrgos, Palladio, Partheni, Pelagos, Peleta, Perdikoneri, Piana, Pikerni, Rizes, Stemnitsa, Tropaia, Valtesiniko, Vlacherna, Zevgolateio
Subtotal			2	

¹ The villages from which the samples were collected are indicated in italics, ² The sample included 13% of *A. sativa* and 87% of *A. byzantina* seeds, ³ The sample included 25% of *A. sativa* and 75% of *A. byzantina* seeds.

Out of 141 collected samples, 34 belonged to genus *Triticum*, 25 to *Phaseolus*, 17 to *Zea*, and 15 to *Solanum*. The remaining 50 samples were vegetables, legumes, cereals, and other crops (Table 3). In terms of spatial scale (number of locations visited), the AUA (2018–2021) missions were richer than the KWIK (1942) [24,25] and the rest of the missions, as samples were collected from 34 (in AUA), 22 (in KWIK), and even less villages from other missions. Some of the missions were aiming to collect landraces found in an area, while other missions aimed for specific species, such as the FAO's 1968 and the NIAS mission that collected only cereals [26,31,32]. The FCPI, Institute of Pomology (PI) and Vine Institute (1983, 1985, 1986, 1988) missions collected only pulses, grapevine landraces, fruit-nut tree landraces, and wild crop relatives [28–30]. Even though the KWIK collection is richer than the AUA mission in number of samples, in the KWIK collection only a small number of vegetable landraces were collected because their cultivation was rare in 1942. Although in the GGB (2006) mission less samples were collected than in the AUA mission (2018–2021), the collection took place in less villages than in the AUA mission (10 instead of 34). Therefore, the value of the present study collection to access the genetic erosion and status of landraces is evident for both collected, as well as the non-collected (however recorded as an obsolete cultivation) landraces/local varieties germplasm. Furthermore, these findings could assist to define a proper strategy for ex-situ and, more importantly, in-situ conservation.

3.2. Crops of Arcadia and Their Landraces

3.2.1. Wheat and Other Cereals

References regarding grain cropping in Arcadia date since antiquity [37]. Pausanias [38] mentions that after the death of Nyctimus (a King of Arcadia), Arcas was enthroned as king, and he was the one who with the help of Triptolemus (a mythical person taught by goddess Demetra in the art of Agriculture) trained the residents of Arcadia in the ways of agriculture and how to weave and make bread, hence, to cultivate wheat. Even though Arcas is a mythological character, this reference has importance as it defines an era that Arcadia residents changed from a hunting to an agriculturally based society. According to Thucydides, Arcadia was not suitable for wheat cultivation regions [39] due to its mountainous terrain. Historical evidence derived from Herodotus and Pausanias highlight that acorn bread was consumed by the inhabitants of the mountainous district of Arcadia [40]. However, there are references mentioning that less mountainous areas or plateaus were used for cereal cultivation during the classical era [41].

Much later in the 18th century, Parveva et al. [42] mentions that cereals and other grain crops were poorly cultivated in Arcadia (only for self-consumption). In the 20th century, the average wheat yields (560 kg per ha) produced in Arcadia were higher than those produced in Chios Island and Macedonia [43].

In 1948, wheat landraces were sown in most of the wheat cultivated areas (73.4%), while improved cultivars occupied 26.6% of the land [44] (Table 4). In 1957 and 1958, wheat landrace acreage increased, contrary to what happened in other regions such as Lefkada and Lemnos islands where mostly cultivars were cropped [16,17]. This probably happened due to the mountainous terrain and the inability of commercial cultivars to produce comparable, to locally adapted landrace, yields. The total area cultivated with wheat increased from 1946 to 1957 from 28,051 to 38,362, respectively, and the ratio between landraces and cultivars remained nearly the same [44,45] (Table 4).

Most of the samples of AUA research carried out in Arcadia belonged to cereals. Among 66 seed samples collected during AUA missions from 2018 to 2021 or donated to AUA, 34 wheat accessions and four different wheat landraces are mentioned in Table S2. Regarding our literature search, the oldest reference on wheat landraces found was made by Palaiologos [46] in 1833, who mentioned that there were two main types of wheat in Greece: one sown in plains and low altitudes, namely “Kokkinostaro”, “Chondrostaro”, “Mavrogeni”, and “Mavragani” depending on the location and the type sown, and another type sown in mountainous or high-altitude areas, namely “Asprositario”, “Psilositaro”, and “Zoulitsa” [46]. Furthermore, Palaiologos [46] added that there were wheat landraces called “Diminia” and “Triminia”, respectively, with short biological cycles up to 40 days. Gennadios [47] mentioned two landraces (“Zoulitsa Arcadias” and “Asprostaro”) that were cultivated in Arcadia in 1914. According to Papadakis [48] in 1929, one wheat form was cropped in Arcadia (“Mavragani Vytinis”), while two other wheat forms (“Asprositario” and “Trimini”) were mentioned to be cropped in mountainous regions and plateaus of Peloponnese without further specifications on locality (probably including Arcadia). Much later, in 1948 and 1959, Kokolios [44,45] mentioned eleven different names of wheat landraces cropped in Arcadia, among them were “Mavragani” and “Arapiko” characterized as durum wheat, and “Tsougrias” (tolerant to frost), “Grinias” (tolerant to frost with fast growth), “Zoulitsa”, “Asprostaro” (tolerant to frost), “Driminitza”, “Chondrostaro”, and “Vlachostaro” as bread wheat [44]. More specifically, Papadakis [48] mentioned the wheat landrace “Asprostaro Peloponnese” (belonged to *T. turgidum*) that had been cultivated in Tripoli for many years.

Table 4. Wheat landraces and cultivars grown in Arcadia during 1946, 1957, and 1958 (adapted from Kokolios [44,45]).

Improvement Status	Name	Area (ha)			Mean Production (kg/ha)		% of Total Wheat Cultivated Area		
		1946	1957	1958	1957	1958	1946	1957	1958
Landrace	Asprostaro	4208	3565	6181	1408	645	15.0	12.1	17.6
	Vlachostaro	84	150	50	1408	563	0.3	0.5	0.1
	Grinias		700	208	1408	915		2.4	0.6
	Driminitsa	3310	3074	4908	1408	1125	11.8	10.5	14.0
	Zoulitsa	1767	960	1338	1408	1174	6.3	3.3	3.8
	Koutroulis			315		2146			0.9
	Mavragani	7293	3281	5300	1408	1077	26.0	11.2	15.1
	Plaka		3760	2083	1408	1100		12.8	5.9
	Platitsa		50	3690	1408	1454		0.2	1.1
	Tsougrias	3927	5253	5278	1408	1063	14.0	17.9	15.1
	Chondrostaro		745	220	1408	768		2.5	0.6
	Undefined		170	25	1408	1076		0.6	0.1
Subtotal landraces		20,589	21,708	29,596			73.4	73.8	75.0
Cultivar	G-38120		150	545	1280	1910		0.5	1.6
	G-46025		976	810	1280	1721		3.3	2.3
	G-38290		1397	1060	1280	1921		4.8	3.0
	G-46713			56		1950			0.2
	Mentana	3366	958	1115	1408	2963	12.0	3.3	3.2
	G-58383			47		2775			0.1
	Kampera		15	68	1408	968		0.1	0.2
	Kouanterna	3647	2306	1791	1408	2165	13.0	7.8	5.1
	Xilokastron		20	53	1408	1072		0.1	0.2
	Rieti		1375	3074	1408	1554		4.7	8.8
	Eretria		65	110	1408	1292		0.2	0.3
	Lemnos	449	435	37	1408	1550	1.6	1.5	0.1
Subtotal cultivars		7462	7697	8766			26.6	26.2	25.0
Total		28,051	29,405	38,362			100.0	100.0	100.0

During AUA collecting missions (2018–2021), most farmers in many villages mentioned the wheat landrace “Asprosiiti”, and in very few cases “Asprostaro”. Like Bennett [26], we assume that “Asprostaro” and “Asprosiiti” should be synonyms because these names have the same meaning (white wheat), while the other wheat landrace names mentioned were totally different (Table S2). During our expeditions, three samples of “Asprosiiti” were collected from Kato Davia and Stemnitsa villages. According to several interviews, the seeds of “Asprosiiti” are reddish or whitish, which is in agreement with the Papadakis reference [48] (“Asprostaro Peloponnissou” have whitish seeds and “Kokkinosporo Asprostaro Peloponnissou” have reddish seeds). This landrace has been known since the Classical era [49] and is nowadays used for making bread. “Asprosiiti” (*Triticum durum*) was also used for “Koliva”, a dish based on boiled wheat and other symbolic ingredients used in the Eastern Orthodox Church ceremonies for commemorations of the dead. “Asprosiiti” was also used for bread or for making “prosforo”, an Greek Orthodox offering bread for the divine liturgy. Additionally, it was used for traditional Greek pasta called “Hilopites” or “Hyloupites”, made from flour, eggs, milk, and salt.

Furthermore, and according to the elderly inhabitants of Arcadia, the traditional variety “Mavragani” (meaning the black awn) is sown in fertile soils in October and harvested in June. According to Stavropoulos et al. [33], “Mavragani” types are highly adaptable and were cultivated in Arcadia, as well as in many other regions such as the Greek islands Lemnos, Lesvos, and Lefkada [16,17,50].

Another important variety for wheat production well known in Arcadia until the 1970–1980s was the landrace “Zoulitsa” [48,51]. According to the interviews, “Zoulitsa”

was used for good quality bread, and it was tolerant to cold and snow, which is appropriate for cultivation at high altitudes. Karamanos et al. [52] also mentioned that it was drought tolerant compared to other Greek wheat landraces. Economou [53] also referred to “Zoulitsa” as a landrace cultivated in Gortynia (north-western Arcadia).

Moreover, other landrace names were mentioned in the interviews (to be cultivated in the past) such as “Griminitsa” or “Drominitsa” or “Drimitsa” (most likely “Driminitsa”, Table S2), “Martiako”, “Spano”, and “Platina”. The bread-making landrace “Tsougrias” (*Triticum aestivum*) was reported to be cold resistant. An awnless landrace cultivated in South Kynouria was called “Korkoletsis”, which means very light snow water. “Diminitis” was a short biological cycle landrace tolerant to rocky and infertile or flooded soils used for bread, also found in Lesvos Island [50]. A wheat landrace with short and minimal awns “Kontoula” adaptable to infertile and non-arable soils was also mentioned. The abovementioned landrace was characterized by its short and minimal awns. Additionally, farmers who were interviewed confused several cultivars such as “Rempetsa”, “Tserto”, “Conderna”, “Errieti” or “Rieti”, and “Mentana” as landraces, even though they were imported in Greece during the first half of the 20th century [48]. This confusion can be explained by the concurrence of these old, improved varieties with the landraces. Most persons interviewed mentioned that the most significant reason for abandonment of wheat landraces was their replacement by improved cultivars [33].

Only one barley sample was collected in Arcadia, called “Ntopio” (meaning local). This landrace is still cultivated, because according to farmers it has many advantages, such as that it can be grazed one or more times, has good tillering, and produces hay as well seeds. The barley landraces were used to make “wild bread”, in “Smigadi” mixtures, intercropped with wheat and oat, and as animal feed as pasture or hay. Another barley landrace was the spring barley “Martiako”, which was named after the month it was sown (March). This landrace has been known since the first half of the 19th century [47] in the northeastern Peloponnese. Other barley landraces mentioned were “Exagoni” (*Hordeum vulgare* var. *hexastichon*, six-row barley), a landrace tolerant to winter frosts called “Arapiko”, and “Disticho” a *Hordeum vulgare* var. *distichon* landrace. Besides wheat and barley landraces, “Smigadi” (meaning mixture) was also reported to be used for various purposes. “Smigadi” usually was a mixture of wheat and barley or rarely oat, aiming to achieve a minimum production according to the climatic conditions favoring one of the two components (i.e., wheat or barley) or both [46,53,54].

Oat (*Avena byzantina*) landraces were used for animal consumption as hay or pasture. Apart from *A. byzantina*, two samples including *A. sativa* seeds were found, however *A. byzantina* was dominant. Rye (*Secale cereale*) was used as in other areas of Greece [16] like a raw material for rope making or feed, as well as a mixture with wheat for food.

Contrary to the unchanged acreage cultivated with landraces from 1948 to 1958 (Table 3), the number of different Poaceae species found in Arcadia in 1942 (76 samples) was reduced severely compared to the ones found in the same location in 2006 and during the AUA expeditions (2018–2021) (Tables 1 and 3).

Maize (*Zea mays*) samples were collected during the AUA missions (2018–2021) in many villages (Table 3). Maize was cultivated for first time in Greece in the Ionian Islands in 1576, and from this region the cultivation spread to the Balkan peninsula [55,56]. In the mid-17th century, maize was imported to Morea (a name used for Peloponnese), and specifically the south bordered prefecture of Arcadia [55]. However, as the name of the crop “Arabositos” (meaning the wheat of the Arabs) (syn. “Arabositi” or “Arapositi” or “Afraposito”) indicates, it might have been imported from other locations besides the Ionian Islands, such as North Africa [55]. Additionally, a synonym to “Arabositos” in the Greek language is “Kalamboki” or “Calambochi” probably from the Turkish “Kelembek”; these two names might be related to the import source.

After more than two centuries of maize adaptation through evolution in Greek microclimates, Talellis [57] mentioned in 1970s that five types of corn could be found in Arcadia prefecture, named “Bertzsovitiko”, “Tripoleos local”, “Daras local irrigated”, “Milia lo-

cal", and "Milia local white" (Table S2). Furthermore, Stavropoulos et al. [33] referred to "Kremasto" as the most mentioned landrace name in the 2006 GGB mission in Arcadia. In total, 17 samples of maize were collected during the AUA missions, with six different names ("Afraposito", "Arapositi koukla", "Ntopio", "Arapositi", "Arapositi xeriko", and "Arapositi lefko") (Figure 2) (Table S2). Several landraces were believed to have been lost, such as "Kremasto" or "Psareiko" (thick stem with ear formation quite high) and "Partheniotiko" (meaning from Partheni village) used for making a type of bread that was called "Bobota".



Figure 2. Maize landrace ears and seeds collected in 2021 from the AUA mission in Arcadia. (a) "Arapositi" collected in Leontari village, (b) "Arapositi xeriko" collected in Perdikoneri, (c) "Arapositi" collected in Karkalou, (d) "Arapositi lefko" or "Kalaboki lefko" seeds collected in Leontari.

Several farmers interviewed related the color of the corn cob to the tolerance of drought, with the red ones being the tolerant and the yellow being non-tolerant. In addition to the red and yellow corn cobs, the "Birbila" (multiple-colored ones) were also reported to have yellow, red, and dark seeds. According to the interviews, the seeds of the local maize landraces were used for human consumption, while the rest of the plant was fed to animals.

3.2.2. Pulses and Fodder Legumes

Many legume landraces (34 samples in AUA mission) are still cultivated in Arcadia (Table 3). Common beans (*Phaseolus vulgaris* L.) were imported in Italy in the 16th century and from there in Greece in the first half of 17th century [58]. Since its introduction to the area known nowadays as Greek territory, farmers could not discriminate common beans from cowpeas (only the botanists knew the difference) which had been cultivated for many centuries. After its introduction, the common bean was thought by the farmers as a variety of cowpea [59]. Regarding the region of Arcadia, common bean landraces are highlighted

in KWIK mission (1942), where the number of samples was higher compared to other species (Table 1).

In 1960, Panou [60] mentioned that in Arcadia, 10 botanical types of common bean (four forest, two marine, and four mountainous climate types) were cultivated. The mountainous climate types (*Montanus oblongus*) had cylindrical seeds and were tolerant to frost, drought, and fungal diseases, while the forest types (*Silvaticus ellipticus*) had elliptical oval seeds that produced plants favored by the cold and wet climatic conditions [60]. Finally, the marine type (*Maritimus-compressus*) had large and broad, tapered pods with nephroid seeds, and the plants preferred hot and wet climate conditions and were tolerant to anthracnosis [60]. The landraces “Topiki aspri” meaning local white, “No. 1”, “Nana” meaning short plants, “Zargana” meaning garfish to indicate the slender and long pod of the landrace, “Barbounia” meaning red mullet fish due to the shape and the color of the landrace pods, “Tegeas” named after the village of Tegea where it probably originated, “Nestani local” named after the “Nestani” village, “Kakouri local” named after Artemisio, formerly Kakouri village, “Imi-gigantes” and “Megaloï imi-gigantes” were also mentioned [60]. The “Imi-gigantes” (meaning semi-giant) type was also reported in Partheni village during the AUA landrace collecting expeditions (Table 3). An interesting fact is that out of four of the 10 local names mentioned in Panou [60], almost half of them originated from Vytina, underlining this village as a common bean cultivation center.

The common beans, “Barbounia”, “bean Chelmos”, “bean Alonistainas”, “Tsaoulia”, “Kontoules”, “Vanillies”, and “Mavrofasoli” were collected in 2006 by GGB mission in seven villages, with three of them taking their names from the areas where they were originated [33] (Table S3).

During the AUA mission (2018 to 2021), common bean germplasm was found in many villages (Tables 3 and S3). Even though 11 different local names were reported, only four different types were collected. Additionally, two “Tsaoulia” subtypes were recorded and collected in Perdikoneri village; the “Tsaoulia-fardia” meaning wide “Tsaoulia” and “Tsaoulia-strifta” meaning twisted were used as dry beans and green beans, respectively. Additionally, two subtypes of “Lopia” were mentioned in Agriakona village, with “Lopia aspra” meaning the white ones and “Lopia mavra” meaning the black ones, likely due to their seed color. Most used names are characterizing the color, shape, or size of the pods or seeds. Same practices were adopted by Italian farmers used for naming landraces such as “Fagiolo Bianco”, “Raparino Gigante”, and other Italian common bean landraces [59,61].

Apart from *Phaseolus* samples, many other legume landrace accessions were collected or reported in Arcadia, such as faba beans, cowpeas, vetches, *Lathyrus* species, and peas (Table 3). Peas were mostly referred as “Mpizeli ntopio”, which means pea local type with no reference to a particular name. It is quite common that when only one landrace is cultivated in an area, farmers do not give it a particular name because there is no need to differentiate it from others. Even though several cowpea landraces were mentioned, only one sample was collected from Leontari village called “Ntopio”, meaning local. Other common names for *Vigna unguiculata* cultivated in Arcadia were “Ampelofasoula” or “Mavromatika”. These landraces were cropped for food in monoculture or intercropped with corn as well as with chickpeas. Other cowpea landraces mentioned to be cultivated (however, they were not collected) in Pikerni village were the “Argitiko”, meaning the one from Argos town (north-east of Arcadia), and “Charonia” (tolerant to aphid attack) in Vlacherna, Magoulia, and other villages.

Both *Lathyrus sativus* and other *Lathyrus* spp. landraces were reported in the interviews to have been cultivated in the past, with white, blue, light blue, red, yellow, and pink-blue flower colors, however no samples were collected. Indeed, in the KWIK mission, several *L. cicera* samples and a *L. clymenum* sample were collected [24]. *Lathyrus clymenum* is still cultivated in Santorini and Karpathos Islands currently [62]. A Cyprus vetch (*Lathyrus ochrus*) landrace was also recorded (not collected) called “Baboulia”, which was used to make a pulse puree called fava, also made from *L. clymenum* and *L. sativus* in other locations in Greece. A similar common name was used for *L. ochrus* landrace in Kythera

Island. This species is cultivated in several Aegean Islands like Lemnos, Lesvos, and Skyros [16,50,63]. Lathyrus species were also used for feed (hay or pasture). One of the landraces recorded (not collected) was used as feed and called “Arnokoukia”, meaning faba beans for sheep. “Rovitsa” (*Vigna radiata*), “Rovi” (*Vicia ervilia* L. Wild), and “Vikos” (vetch, *V. sativa*) have been cultivated in the past for food or feed and were not collected during the AUA mission. A study regarding the characterization of *V. ervilia* landraces originated from Greece and other countries revealed a great morphological variability among the landraces from Arcadia, where four different groups were formed related to various locations both within Greece and abroad [64].

Four faba bean samples were collected in the AUA missions without any local names (Table 3). However, several faba bean landrace names were recorded as being cultivated in the past according to the interviews (Table S3). Terzopoulos et al. [65] studied faba bean landraces originating from Arcadia and clustered them in three groups, highlighting their great morphological variability, which was also reported by Terzopoulos and Bebeli [66] using ISSR markers.

One sample of chickpea and one of lentil landrace was donated during the AUA missions without any information about a local name (Table 3). However, various types of chickpeas and lentils according to their size were also cultivated in the past (Table S3). Gleridou [67] studied the genetic relation of Greek-origin lentil landraces and clustered Arcadian lentils in two groups. One group was comprised by lentils originating from Vytina, Megalopoli, and Platana and the other contained landraces originating from Vytina and Chrisovitsi. The ones from Chrisovitsi and Vytina were related with other landraces from Laconia and Korinthia at the north and south of Arcadia, while the rest of the Arcadian landraces were related to landraces from Peloponnese and Crete, indicating that the last ones may have been introduced from other locations [67].

There were no samples of lupins collected during the AUA missions, however according to several interviewed locals, the lupins (*Lupinus albus*) were used for soups, eaten raw after debittering, and used (*L. luteus* and *L. albus*) for protecting crops from herbivory (non-palatable by sheep) or as margins in their fields. *Lupinus luteus* was also reported in the interviews to be grown as a volunteer plant (Table 3). Overall, genetic erosion affected *Lathyrus* spp. and other species, such as bitter vetch.

3.2.3. Vegetables

During the AUA missions (2018–2021), vegetables was the most diverse (regarding species number) category compared to cereals, legumes, nut and fruit trees, and other crops (Table 3). Among vegetable landraces samples collected, the largest number were tomatoes (*S. lycopersicum*) (Table 3). Tomato samples were collected from several villages with landraces’ names related to fruit shape, such as “Kidonati”, meaning having the shape of quince fruit, “Strongili”, meaning round shape, “Chondrokatsari”, meaning thick with fuzzy skin, “Voidokardia”, meaning the shape of oxheart, and “Miteri”, meaning pointed (Table 3). Another tomato landrace recorded was “Triantafillia”, meaning the roses, probably because of the pinky color (Figure 3), whereas “Atze” mentioned as a landrace was most probably an obsolete old Italian variety.

During AUA missions (2018–2021), the “Ox heart” shape tomato was reported in the interviews to require high elevation. Landraces with the ox heart shape have been found in other countries, like the Italian “Cuore di Bue”, which is an open pollinated beefsteak heirloom variety marketed by many seed companies [68]. The high appreciation of customers for this table tomato variety results from the good quality, color, and flavor, and it is also an excellent source of antioxidants, dietary fiber, minerals, and vitamins [68–70]. Stavropoulos et al. [33] reported that several landraces were collected in 2006, with the most famous being either the “Dareiki” or “Katsareiki” or “Chonoti”, depending on the area grown (Vytina, Elliniko or Leonidio). Tomato was used not only fresh but also as preserved paste to have tomato year-round, since all the landraces were cultivated during

summer. Another important fact, as highlighted in an interview, was that the introduction of foreign seeds was quite common in the past.

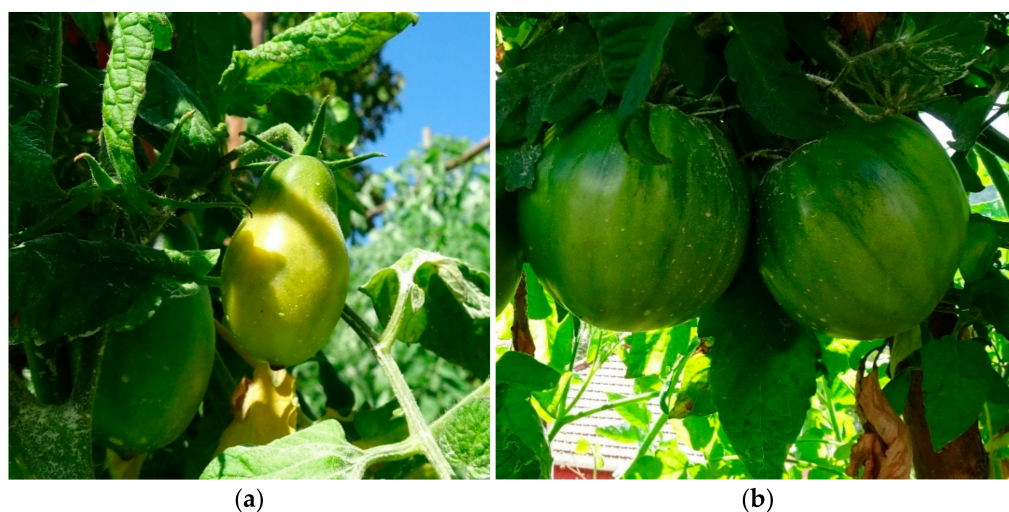


Figure 3. (a) Immature fruit of tomato landrace “Kydonati”, (b) immature fruit tomato of landrace “Strogili” found in Kastri village.

Several pepper (*Capsicum annuum*) landraces were recorded, however only three samples were collected, one from Vourvoura, named “Kaferi” meaning spicy, and the other two from a village near Tripoli, where “Kaferi” and “Makria” (meaning long shape) were found. Other names recorded were “Prasini” (green), “Kokkini” (red), and “Mikri” (small), with all of these names indicating either the color or the size of the fruit.

The most popular eggplant landrace in Greece (*Solanum melongena*) named “Tsakoniki” is cultivated in Leonidio village [33]. In the AUA missions, only two accession samples of eggplant landraces were collected from two villages, Platanos and Leontari, under the name “Ntopia melitzana”, meaning local eggplant (Table 3). Other landrace names mentioned were “Mavri” meaning black and “Melisses” meaning bees, probably because they were not bitter but sweet as the honey which comes from bees.

Only commercial potato varieties (*Solanum tuberosum*) were mentioned in Arcadia (“Spunta”, and “Morfona”, “Kennebec”, “Sebago”, “Banner” and “Katahdin”), hence, there were no samples collected.

Regarding zucchini (*Cucurbita pepo*), the landrace “Kobokolokytho”, meaning the knotted zucchini, was mentioned. This is a famous landrace conserved by the Institute of Plant Breeding and Genetic resources in Greece [71] and preferred by consumers in southern Greece. Another yellow and long landrace was mentioned, however without a local name.

Pumpkin was also frequently mentioned by the locals as being cultivated in Arcadia; a landrace mentioned was the “Bombino” or “Bobino” (Table 3), while other local names reported included, “Kobokos”, “Aploteri”, and “Konti”. Crookneck pumpkin “Glykokolokytha” (*Cucurbita moschata*) which is used for making sweet pies was another landrace cultivated in gardens for own consumption.

Melon landraces named “Mouroukeiko” and “Riziotiko” were collected in the village Rizes. Other melon landraces mentioned were “Chimoniatiko”, meaning winter melon, “Argitiko”, meaning originated from Argos town (also located in Peloponnese), and “Kakoureiko”, meaning from Kakouri village (Kakouri is the former name for Artemisio village) in Arcadia. Other local names reported were “Chondro”, meaning fat or thick, “Xiriko”, meaning tolerant to drought, and a grey colored (according to the locals) landrace named “Strongylo”, meaning round.

A cucumber (*Cucumis sativus*) landrace was collected from the village of Platanos, while a local in Leontari mentioned a cucumber landrace named “Kastravetsa”, which in

Albanian means cucumber [72]. This was also mentioned and cultivated in Lefkada [17]. A watermelon (*Citrulus lanatus*) landrace named “Plexenia” was mentioned, but its cultivation has been abandoned. Other watermelon landrace names reported were “Strongilo”, meaning round, and “Makroulo”, meaning long.

Another type of vegetable with several references during the AUA (2018 to 2021) missions was garlic (*Allium sativum*). Although 16 areas of garlic cultivation were mentioned, only one sample was collected from Pikerni (Table 3). Polyzos et al. [73] characterized phenotypically, among others, five landraces collected in Arcadia and studied their quality traits. All the landraces from Arcadia were clustered within a group, except one from Stadio Tripoleos that was included in another cluster. Avgeri et al. [74] mentioned that garlic landraces are cultivated in several locations such as Tripoli, Mavriki, Lithovouni, Stadio Tripoleos, and Manthurea in the Arcadia prefecture. These landraces originated from Arcadia and presented variability in their organosulfur compounds, sugars, phenolics, and pyruvate, highlighting both genetic and environmental effect variability among different locations in Arcadia.

Regarding okra, (*Abelmoschus esculentus* L.) two large-sized landraces were collected in Kosmas and Platanos, namely “Ntopia”, meaning local (Figure 4), and references regarding okra were also made in the Agiorgitika, Kapsas, Pikerni, and Limni villages.



Figure 4. Platanos local okra landrace pod samples (ruler in cm).

In 1942 during the KWIK mission, only seven samples of vegetable species were collected. On the contrary, 52 samples were collected during the GGB mission in 2006 and 36 during the AUA missions from 2018 to 2021 (Table 1). Many farmers mentioned that the absence of irrigation infrastructure was a major constraint for vegetables cultivation for most farmers. After World War II, the availability of irrigation increased gradually in the villages of Arcadia. Additionally, vegetable seeds were imported from neighbor villages and/or bought from agricultural shops. Later, the locals started buying plantlets instead of seeds because it was easier. This changed the practice—to buy plantlets instead of sowing seeds caused genetic erosion in the vegetables’ landraces. However, a large variability of vegetable landraces was kept by two groups of people, the first being those who farmed in the vegetable gardens, mostly elderly people, who continued the practices of the past (keeping the old seed). The other group consisted of younger enthusiasts who returned to their homeland with memories of the past and found these landraces by elders or other enthusiasts who wanted to continue the traditional agriculture.

3.2.4. Grapevine

References regarding the wine of Arcadia date back to the Ancient Greek times; Theophrastus in his book called *History of Plants* mentioned that the wine from Heraea (a

region in western Arcadia) caused insanity among men and pregnancy among women [37]. Additionally in Peloponnese, there is the “Grapevine of Pausanias” [75], a wild vine (*Vitis vinifera* subsp. *silvestris*) with diverse references regarding its origin since the classical era, probably a myth [76] but without Pausanias referring to it in his book [38]. However, the name of this vine underlines the importance of grapevine cultivation for Arcadians.

Valuable information regarding the names of grapevine varieties traditionally cultivated in the area, as well as their berry color, was derived from the interviews that took place during AUA missions compared to local grapevine varieties reported in literature since 1943 [75–83] (Table 5). Forty-four names including synonyms, according to the locals, were recorded (Table 5). Names, grape size, and berry color were not enough to identify a local grapevine variety without a full ampelographic description. In every name cited, an ampelographic characterization of living material of the specific variety must be assessed to provide a safe conclusion regarding its origin, because Greek grapevine varieties are of polyclonal composition and are simple or complex natural hybrids [75,84].

Table 5. Names of landraces of grapevine and their synonyms recorded in villages of Arcadia and literature references.

Name of Local Variety ¹	Synonym ²	Color of Berry ²	1943, 1944, 1949 [77–79]	1965 [80]	1982 [81]	1986 [82]	2010 [75]	2019 [83]
Aetonychi aspro	Nichaki	W ³		v ⁴	v			
Aetonychi mavro		B	1943		v	v		
Agiorgitiko		B	1943		syn. ⁵ mavro Nemeas	v	v	
Agoumastos			1943					
Asprokokkinadi	Perachoritis							
Asproudi		W						
Asprovaria		W					syn. Plyto	
Avgoustelida		W	Avgoustella, 1949					
Bakouro	Moschofilero		1944 as Bakouri					
Chontrorogo		W						
Eftakilo		B			v			v
F(i)leri					v, as B ⁶	v as B	v ⁷	
Fraoula		Rs	1943		v	v	v	
Glykasprouda		W						
Glykerithra		W	1943				v	
Kerino							syn. Razaki	syn. Razaki
Kokkinadi			1943, as ⁶ of Roditis					
Mavrokokkinadi								
Kokkineli		B	1949					
Kokkino-Korinithi		Rs						
Kolliniatiko		B	1943		v			
Krasostafylo aspro		W						
Krasoudi		B						
Kidonitsa		W					v	
Mavroudi	Koraki, Krasostafylo, Volitsa, Kolliniatiko	B		1966	syn. Agiorgitiko	syn. Agiorgitiko	v	
Muscat of Hambourgh		B			v	v	v	
Moschofilero		W, Rs				syn. Mavrofilero		
Moschostafylo		W	1943			v		
Parachoritis		W				syn. Savatiano	syn. Savatiano	
Peristera		W						
Platana		B						
Proimadi		B						
Razaki		W	1943		v	v	v	v
Roditis	Alepoudi	P	1943		v	v	v	

Table 5. Cont.

Name of Local Variety ¹	Synonym ²	Color of Berry ²	1943, 1944, 1949 [77–79]	1965 [80]	1982 [81]	1986 [82]	2010 [75]	2019 [83]
Sideritis		Rs	1943	1965	v	v	v	
Skylopnichtis		Dark Rs, W	1944		v		v	
Soultanina		W	1943	1965	v	v	v	v
Thrapsa aspri		W						v as B
Tzetzteri		B						
Varia						v		
Mavrovaria		B						
Kitrinovaria		W					syn. Plyto	
Voidomatis		B	1943					v
Volitsa	Mavroudi	B	1949				v as W	

¹ Local variety names mentioned by the locals and the literature reference are related to the name and not the ampelographic characterization.

² references according to locals, ³ “W” means white, “B” means black, “Rs” means reddish, and “Dark Rs” means dark reddish berry color,

⁴ indicates that this landrace is reported in the reference within the same column, ⁵ indicates synonym, ⁶ indicates the color of berry, ⁷ indicates that this is mentioned as a variant in the reference of the same column.

Another uncertainty related to synonyms is that a local variety may have different names in different areas and vice versa. For example, the local variety “Aetonychi” is reported to have either a white or black berry color. Even though the name is the same and the abovementioned grapevine landraces are considered relatives [77], the use of enzyme polymorphisms proved that they belong to two different varieties [85]. The same happened with “Mavroudi”, which was considered a synonym of “Agiorgitiko”, however biochemical [85] and molecular [86] methods showed that it was a different local variety [82,87]. Additionally, there are names that identify the use of the grapevine, such as “Krasostafylo”, meaning grape for making wine. The word “Krasostafylo” can be used for all the wine making varieties [88].

If research will be conducted in other areas of Arcadia, more local variety names could be found, as has happened in the collecting samples of Vine Institute (VI) during 1983 (Table 6). In this mission, 34 varieties of *Vitis vinifera* and one of *V. labrusca* were collected in 10 villages, as well as one sample of wild *V. vinifera* subsp. *sylvestris*.

In our research many local names have been reported, as shown in Table 5. The synonyms of grapevine local varieties were very common during the interviews in different villages in Arcadia, as was recorded with the local varieties “Korakades”, “Mavroudia”, and “Kolliniatiko”. The local variety “Alepeou” or “Alepoudi” is a relative or clone of “Roditis” [75,76,79,82]. A farmer mentioned that the old name of “Moschofilero” was “Fileri”, even though the scientific research concludes these two as variations of the same local variety [75]. Another farmer described “Kokkineli” as having a loose bunch and tending to grow as an arbor vine, with traits similar to those of “Sideritis” [75]. According to Stavrakakis [88], the synonyms can be used safely only when an ampelographic description of each of them exist.

Several of the grapevine varieties mentioned in Arcadia are famous in Greece, such as “Agiorgitiko”, which differs from “Mavroudi”, “Mavraki”, “Mavrostafylo” and “Karvouniaris” [86]. The local varieties “Moschofilero” or “Moschofilero” have an aromatic character (moscho- means aromatic), whereas other biotypes (clones or mutants) such as “Asprofilero”, “Kokkinofilero”, and “Xanthofilero” are genetically close but they do not present an aromatic character [88]. Additionally, the local varieties “Fileri Menidiou” (Attica) and “Fileri Tripoleos” are closely related as they are both biotypes of the local variety “Giouroukiko”/“Armeletousa” but they differ from “Moschofilero” [88]. The use of molecular markers proved that the local variety “Moschostafylo” [77] is different from “Moschato aspro” of Samos and also from other muscat varieties. The local variety named “Glykerithra” originated from Peloponnese [89]. Other well-known Arcadian varieties are “Razaki”, “Sideritis”, “Parachoritis”, and “Roditis”, which have wide use in viticulture [82].

Table 6. The names of local grapevine varieties at villages in Arcadia collected during 1983 by V. Michos, Institute of Viticulture.

Local Name	Berry's Color	Location (Village)	Use
"Agrioklima" syn. "Koliiniatiko"	n/a ¹	Mavrogiannis	Wine
"Akamatis Kokkineli"	Black (B)	Nymfasia	Wine
"Aphissiko-Ariodema"	W	Agios Georgios	Wine
"Aspro Evgeniko"	White (W)	Agios Georgios	Wine
"Asprouda"	n/a	Skortsinos	Wine
"Asprouda Dimareiki" syn. "Peristera"	W	Drakovouni	Wine
"Chimoniatiko"	n/a	Skortsinos	Table
"Chondraspouda"	W	Kamenitsa	Wine
"Dimitsanitiko"	B	Theoktiston	-
"Fileri"	Reddish (Rs)	Zygovitsi	Table
"Georgitsianiko"	n/a	Mavrogiannis	Table
"Glikasproudo"	B	Theoktiston	Table
"Kaphthras"	W	Agios Georgios	Wine
"Klima Pafsania" (vine of Pausanias) ²	n/a	Sella Paftratiou	-
"Korakostafilo"	B	Rafti	Wine
"Korios" ³	B	Markou	Wine
"Kouri"	B	Kamenitsa	Wine
"Koutsavitiko"	n/a	Skortsinos	Wine
"Krasoudi"	B	Kamenitsa and Nymfasia	Wine
"Liaro"	B and W	Kamenitsa	Wine
"Mavro Evgeniko"	B	Agios Georgios	Wine
"Mavroudaki"	B	Kamenitsa	Wine
"Merkouri"	B	Rafti	Wine
"Moschasproudo"	W	Theoktiston	Table
"Moschostafilo"	W	Zygovitsi	Wine/ Table
"Moschovaria"	W	Agios Georgios	Wine
"Parachoritis"	W	Agios Georgios	Wine
"Roditis" syn. "Mourga"	Rs	Theoktiston	Table
"Samonichi"	W	Agios Georgios	Wine
"Simigdali"	B	Theoktiston	Wine
"Tzatzala"	B	Agios Georgios	Wine
Unknown	n/a	Mavrogiannis	Wine
Unknown	n/a	Skortsinos	Wine/ Table
Unknown	W	Kamenitsa	Wine
Unknown	B	Theoktiston	Table
Unknown	B	Agios Georgios	Table
Unknown	B	Agios Georgios	Wine
Varia	W	Agios Georgios	Wine
Vergiotiko	n/a	Skortsinos	Wine

¹ Indicates that the berry color was not available, ² belongs to the *V. vinifera* subsp. *sylvestris*, ³ belongs to the *V. labrusca* L.

There are two other groups of varieties, one that is comprised of rare local grapevine varieties, and the other comprised by variety names that are not reported in literature (Table 5). The clarification, if the synonyms of the rare varieties belonging to the same local grapevine variety can be assessed through ampelographic and genetic characterization, as has happened with "Kydonitsa" and "Thrapsa" [90]. In Arcadia there are recorded varieties whose ampelographic comparison proved that they were introduced from other areas with the same or different name [90]. For example, the Cretan varieties "Plito" and "Thrapsa" (biotype of variety "Mandilaria") are known in Arcadia with the synonyms "Asprovaria" (syn. "Kitrinovaria") and "Mavrovaria", respectively [88]. "Volitsa mavri" is a different variety from "Mavroudi", "Koraki" ("Mavrokorakas"), and "Kolliniatiko", whereas "Volitsa aspri" is identical to "Asproudi Achaia" (Achaia, neighboring prefecture) [88]. Regarding "Volitsa mavri", it has been wrongly mentioned that it is a close relative with the variety "Baliska", which is mentioned by Pliny the Elder, and the Albanian variety "Vlosh", as well as its parental variety Cabernet Sauvignon [91]. On the contrary, the use of SSR molecular

markers proved that Cabernet Sauvignon is a natural hybrid of varieties of Cabernet Frank and Sauvignon Blanc [92,93].

All the above indicate that Arcadia has a diverse grapevine germplasm which has been adapted to Arcadia environmental conditions and has a potential to be exploited commercially and in breeding programs.

3.2.5. Fruit Trees

Historical evidence highlights that the agricultural land uses seem to change over time, affecting tree landrace number (or local varieties, as they are called when we refer to perennial crops) and their distribution. Recent studies regarding Arcadia report that many fields were changed from agricultural to arboricultural since the 1950s due to the market needs [94]. According to local population, after the 1960s many orchards were planted with tree cultivars and their production was exported, such as in the case of sour cherries. Many apple tree orchards were also planted with the sporophyte of Pilafa Delicious because of its organoleptic characteristics that consumers prefer.

During AUA missions (2018–2021), 15 different tree species were recorded (Table 7), with most common being *Pyrus communis*, *Malus domestica*, *Ficus carica*, *Cydonia oblonga*, and *Prunus amygdalus* (observed in 24, 21, 19, 20, and 18 villages, respectively). It is noteworthy that several tree local varieties have different local names depending on the area where they are grown, highlighting the problem of synonymities. For example, *Pyrus communis* was recorded in 24 locations and the locals mentioned 22 different names. Sorted by earliness of ripening, the pear tree local varieties recorded were the following: “Magiatika”, “Moschata”, “Vasilika”, “Neroula”, “Mavrachlada” or “Mavrapida”, “Gavropsachlada” or “Avgoustiatika aromatika”, “Kampanata” or “Kampanapida”, “Kolokythata”, “Chimoniatika” or “Chimonapida”, “Goritsachlada” and “Mariniotika”, “Glempenoures” or “Klempenoures”, “Koulourapida”, “Sousounapida”, “Kontopodarouses”, and “Kontoula”. While “Kroustalia”, a foreign (imported) cultivar, is reported in literature as “Spada”, “Napoleon” or “Spadona” was also recorded [95]. However, this must have been a common practice in naming fruit local varieties, because the same was also observed in Ionian and Aegean Sea islands [16,17].

Quince trees (*Cydonia oblonga*) were recorded in many locations such as Nymfasia where a local variety with small and tasty fruits was mentioned. Quince trees were also reported in many other locations (Table 3), however there were no local names recorded.

Apple tree local varieties and varietal names reported in interviews included “Renedes”, “Firiki”, and “Ntelisio” or “Mila Tripoleos”, a Greek variety with excellent taste but not a very attractive appearance [96]. However, “Renedes” and “Ntelisio” are not traditional Greek varieties, they have been planted since the first half of the 20th [97] century and have been acclimatized both to environment and to the hearts of locals as part of the cultural heritage. The “Mila Delicious Pilafa Tripoleos” were cultivated for the first time in Greece in 1920 as a sporophyte [97], they hold the European Union trademark of Protected Designation of Origin (PDO) and can be produced all over Arcadia in areas with altitude above 600 m [98]. One of the locals also reported that “Starking” apples were imported in Arcadia in 1965.

Fig trees (*Ficus carica*) were recorded in 20 locations and the local farmers mentioned 15 different names. More specifically, the names for fig tree local varieties mentioned were: “Kalamatiana” (white), “Melissa” or “Melissosika”, “Asprosika”, “Karvelosika”, “Kalosika” or “Krounosika” or “Mavrosika”, “Tsapelosika”, “Amouthera”, “Tsoukeles” and “Vasilosika”, “Kokkinosika”, “Proimo-diforo”, and “Livanosika” with several meanings (Table 7). Papadopoulou et al. [99] studied the genetic relation (with random amplified polymorphic DNA analysis and agro-morphological traits) of Greek fig local varieties and found a great genetic distance between local varieties originating in Peloponnese such as “White large” and “Kalamon”. The aromatic profile of dried figs was differentiated among Peloponnesian, “Kalamon” and “Tsapelosika”, and Evian “Kymi” local varieties [100]. Even though studies regarding the genetic relation and aromatic profile of figs have

been published, they report only a small number of local varieties which does not depict the whole image of fig tree diversity. Hence, more studies should be conducted after an extended recording and sampling to evaluate the genetic relation of these different local varieties.

Table 7. Number of different varietal names, number of sites reported, and the meanings of the names.

Species	No of Sites Reported	No of Different Local Variety Names	Local Variety Names and Meanings
<i>Castanea sativa</i> Mill.	3	1	"Kastania" common name
<i>Citrus sinensis</i> (L.) Osbeck	1	1	n/a ¹
<i>Cydonia oblonga</i> Mill.	19	1	"Kitria" common name
<i>Ficus carica</i> L.	20	15	"Kalamatiana" (white) meaning those from Kalamata town; "Melissa" or "Melissosika" meaning the bee figs, probably sweet figs; "Asprosika" meaning white-colored figs; "Karvelosika" meaning bread figs; "Kalosika" or "Krounosika" or "Mavrosika" meaning the black figs; "Tsapelosika", "Amouthera" meaning sandy, probably due to their texture; "Tsoukeles" and "Vasilosika" meaning the royal figs; "Kokkinosika" meaning the red figs; "Proimo-diforo" meaning early; and "Livanosika" meaning those from Lebanon
<i>Juglans regia</i> L.	2	2	"Skliira" meaning hard; "Afrata" meaning fluffy and soft; "Renedes", "Firiki", and "Ntelisio" meaning delicious, or "Mila Tripoleos" meaning apple trees of Tripoli, otherwise called "Mila Delicious Pilafa Tripoleos" or "Tripoleos"
<i>Malus domestica</i> Borkh.	21	7	"Manakolies" or "Manaki" and "Chondrolies" meaning thick olives; "Manaki" olives in "Manaki psilo" meaning small and "Manaki chondro" meaning thick; "Megaritiki" or "Magaritiki" meaning from Megara (olives that look like an acorn); "Grotharia", "Choraitiki" (originated from the village Chora) and "Matsa" used for olive oil extraction and "Barmpouta" that produced large olives; "Chondrolia", "Kalamon" and "Ladolia" "Skliira" meaning hard; "Afrata" meaning fluffy and indicated as soft; "Plakouda" meaning flat; "Strogyla" meaning round; "Imi-afrata" meaning with semi-fluffy/soft nuts
<i>Olea europaea</i> L.	11	14	"Karamela" meaning candy; "Petrokerasa" meaning rock cherries; "Kokkinomavro" meaning red and black; "Aspro" meaning white; "Kitrino" meaning yellow; "Mavro" meaning black; and "Kokkino" meaning red
<i>Prunus amygdalus</i> L.	18	5	"Koromilia" common name, "Agria Koromilia" meaning wild one, "Koumpoulia" and "Mpournelia"
<i>Prunus avium</i> L.	18	7	"Visinia" common name
<i>Prunus domestica</i> L. ssp. <i>insititia</i> .	17	4	"Damaskinia" common name
<i>Prunus cerasus</i> L.	16	1	"Rodakina" common name
<i>Prunus domestica</i> L. ssp. <i>damascena</i>	5	1	"Rodia" common name
<i>Prunus persica</i> L.	6	1	"Voutirapida" meaning with butter taste; "Magiatika", "Moschata", "Vasilika", "Neroula" meaning watery; "Mavrachlada" or "Mavrapida" meaning black colored; "Gavropsachlada" or "Avgoustiatika aromatika" meaning that they ripen in august and they have a nice smell; "Kampanata" or "Kampanapida" meaning bell pear; "Kolokythata" meaning cucumber pear; "Chimoniatika" or "Chimonapida" meaning winter pears; "Goritsachlada" and "Mariniotika", "Glampenoures" or "Klempenoures", "Koulourapida" meaning the cookie pears; "Sousounapida" or "Kontopodarouses" meaning with short legs; and "Kontoula"
<i>Punica granatum</i> L.	6	1	
Total	187	83	

¹ n/a, indicates non-available information.

There are a lot of olive tree local varieties cultivated in Arcadia, some of them originated exclusively from a narrow area (Table 8) [101]. Olive tree (*Olea europea*) local varieties were reported during the AUA mission. More specifically in Kastri village, they mentioned “Ladolies”, meaning olives giving high-yield oil. According to an interview, the oil is a bit heavy and yellowish. The local varieties “Manakolies” or “Manaki” and “Chondrolies”, meaning thick olives, were also reported to be cultivated in Arcadia from 1994 to 1997 [102]. Additionally, in Perdikoneri village, “Manaki” olives were discriminated in “Manaki psilo” meaning small, and “Manaki chondro” meaning thick. Other local varieties reported by locals during the AUA mission, were the “Megaritikiki” or “Magaritikiki” meaning from Megara (seeds look like an acorn), “Grotharia”, “Choraitiki” (originated from the village Chora), “Matsa” used for olive oil extraction and “Barmbouta” which produced large olives. The only table olives collected were those of the “Chondrolia” local variety. All the other local varieties were used for olive oil extraction. Kalamata olives (“Kalamon” landrace) were introduced in Kastri village in 1962 and in Arcadia; “Koroneiki” is reported with its synonym, “Ladolia” [103].

Table 8. Olive oil varieties in Arcadia using as criterion the size of the fruit and the origin (adapted from [101]).

Fruit Size		Origin of Local Olive Tree Variety Names	
		Arcadia	Also in another areas in Greece
Small fruit ("Mikrokarpes")	<i>Liamanako</i> Tyrou ¹ , <i>Mastoidis</i> N.K. <i>Gigas</i> , <i>Mproustsolia</i> , <i>Ntopia</i> Atsiholou		Koroneiki, Mastoidis common
Medium fruit ("Mesokarpes")	Agouromaniko, Gratzounaria, Glykomanako, Kalolia-Korakolia, Megaron, Tsakoniki		Galatsaniki, Kothreiki
Large fruit ("Megalokarpes")	<i>Aetoniholia</i> , <i>Gaidourolia</i>		Kalamon, Konservolia

¹ Names with *italics* indicate that the certain landrace is cultivated only in Arcadia.

Several *Prunus* sp. trees were also reported, among them were sweet cherry (*P. avium*) local varieties such as “Karamela” meaning candy, “Petrokerasa” meaning rock cherries, “Kokkinomavro” meaning red and black, “Aspro” meaning white, “Kitrino” meaning yellow, “Mavro” meaning black, and “Kokkino” meaning red. These names, apart from “Petrokeraso”, result from the exocarp fruit color. The landrace “Late Karamela Tripoleos” was reported to produce the lowest stone weight and “Petrokeraso Tragano Achaia” produced high fruit weight [104]. The most marketable sweet cherries are those with a dark red color, such as the “Kokkinomavro”. However, yellow-colored “Kitrino” sweet cherries are preferred by a niche market [104].

The nut trees mentioned by the locals to be cultivated in Arcadia were almonds (*Prunus amygdalus*) and walnuts (*Juglans regia*). The local names referring to both the aforementioned species were “Skliro” meaning hard and “Afrata” meaning fluffy and soft, which indicates the landrace’s nut hardness. Additionally, an almond local variety with bitter taste was recorded in Agriakona village. Other local varieties reported were “Plakouda”, meaning flat nut shape, and “Strogyla”, meaning round nut shape, and “Imi-afrata”, meaning with semi-fluffy/soft nuts. The latter was imported from Chios Island (East Aegean). Regarding walnuts, one sample was collected from Karkalou village. Christopoulos et al. [105] studied the genetic relation of walnut tree local varieties from Greece. Among them, one landrace from Arcadia (EP13/A, an autochthonous tree) was related to only one landrace from Laconia, while it was quite distant from any other local varieties studied.

Chestnut (*Castanea sativa*) is widely grown in Arcadia, particularly in the borders between Tripoli and North Kynouria. Regarding pomegranate (*Punica granatum*), local variety populations were reported in Agriakona, Artemisio, Rizes, and Stemnitsa villages, but they need to be further studied to define possible variability and organoleptic characteristics.

3.2.6. Medicinals, Aromatics, and Other Species

Theophrastus [106] refers to Arcadia as one of the most productive drug areas during the Classical era in Greece, and several plants found in this location were mentioned, such as *Abies cephalonica*, *Acer monspessulanum*, *Allium nigrum*, *Althaea officinalis*, *Aristolochia rotunda*, *Corylus avellana* vars., *Daucus carota*, *Ecballium elaterium*, *Euphorbia peplus*, *Fagus silvatica*, *Fraxinus ornus*, *Helleborus cyclophyllus*, *Juniperus oxycedrus*, *Juniperus phoenicea*, *Peucedanum officinale*, *Pinus pinea*, *Raphanus raphanistrum*, *Salix fragilis*, *Salix* spp., *Silene venosa*, *Smyrniolum olusatrum*, *Sorbus domestica*, *Tordylium officinale*, and *Veratrum album*.

Out of all the above species, *Daucus carota* and *Tordylium officinale* were mentioned in the interviews, as well as *Abies cephalonica*, the two latter for medicinal use and the first one as an edible. Raisins from *A. cephalonica* were used as medicine for stomach pain, according to the interviews.

Various landraces or populations such as *Calamintha* sp., *Cannabis* spp., *Linum usitatissimum*, *Nicotiana tabacum*, *Ocimum basilicum*, *Origanum majorana*, *Origanum* sp. and others were mentioned in interviews in AUA expeditions (2018–2021) (Table 2). Despite the abundance of references regarding medicinals, aromatic plants, and other industrial species, only *Origanum* samples were collected. Mountain tea (*Sideritis* sp.) and *Mentha* sp. biotypes were recorded in the interviews as being wildly grown in the local mountains of Karkalou and Vaskina. Some of the above landraces disappeared a long time ago (e.g., cannabis, tobacco), due to either a recession in their demand or ban on cultivation.

3.2.7. Wild Edible Plants

Some wild grown edible plants were mentioned in the interviews as being used in the local cuisine, such as *Tordylium* sp., *Anthriscus* sp. (syn. *Scandix* sp.), *Centaureum* sp., *Sonchus* sp., *Cichorium* sp. reported in Leontari, Karkalou, Ano Koutroufa, Nymfasia, and Vaskina villages. These wild edible plants were also reported as local cuisine components in other locations in Greece [107–111].

3.3. Genetic Erosion of Arcadian Landraces

Genetic erosion and its effects on landraces is a dominant issue of the scientific community of biodiversity conservation [4,112–114]. The genetic erosion of the Greek plant genetic resources is highlighted in many references [4,10,16,115]. The genetic erosion of cereals was lower in Arcadia compared to the one observed in Italy by Hammer and Teklu [4]. Comparing the results of the KWIK and the AUA mission, it is obvious that the numbers of samples collected were surprisingly small. However, the acreage of cultivation with wheat landraces has been dramatically reduced. Stavropoulos, [115] estimated that within a short time interval, cereal landraces land cover was reduced by 1–2% of total acreage in Greece while Thomas et al. [16] mentioned the dramatic genetic erosion in Lefkada island. This is in line with the results of the present study, even though many cereal samples were collected in the villages visited by the two different missions (Table 9). These cereals belong to a small number of landraces, and they are cultivated on a small scale or kept as seed samples by the farmers, without frequent cultivation.

Table 9. Estimation of the genetic erosion of landraces of Arcadia comparing the collections of KWIK in 1942 and AUA in 2018/2019.

Botanical Species Category	KWIK (Samples) 1942	AUA (Samples) 2018–2021	Genetic Integrity GI (%)	Genetic Erosion GE (%)
Cereals	46	25	54.3	45.7
Legumes	52	12	23.1	76.9
Total	98	37	38.1	62.2

The number of landraces used for the genetic erosion quantification resulted from the villages visited by both missions (Alonistaina, Valtasiniko, Vytina, Dimitsana, Thanas, Levidi, Pelagos, Pikerni, Stemnitsa, Tzivas).

Legume genetic erosion was more than 15% higher in Greece than the one measured in Italy in 1996 [4] (Table 9). However, at least regarding the common beans, the landrace diversity has not been severely eroded when referring to the number of landrace names. The number of different pulses (in total legume samples collected from Arcadia), has been reduced over time from 95 accessions in 1942 to 47 in 2006 and 32 in 2018–2021 (Tables 1 and 3). Comparing the KWIK, the GGB, and the AUA missions results, we observe that the number of samples has a steady reduction from 1942 to 2021 (Table 1). On the contrary, the number of villages where these samples were found has increased and (Tables 3 and S3). A comparison of the collected samples within the same three villages during the three different missions (KWIK, GGB, AUA) revealed that the number of *Phaseolus* sp. samples reduced over time, with 13 samples in 1942, 12 samples in 2006, and four samples in 2018. Additionally, in the AUA missions (2018–2021), samples of the genera *Lathyrus*, *Pisum* were not collected, while there were four samples of *Vicia* compared to 27 in the KWIK mission in 1942. This sharp reduction of landraces from 2006 to 2018–2021 may be a result of elderly people who were maintaining these landraces and stopped cultivating them due to old age, touristic development, or rural abandonment, as reported in literature [116,117]. Home gardens have been highlighted as hotspots of landrace biodiversity [116,117], and in this context the genetic erosion of cereals is explained, as they are not usually cultivated in home gardens. On the contrary, the genetic erosion of maize has been less rapid than other cereals because it was and still is cultivated in home gardens (Table 3).

Dwivedi [5] reported that Greece lost 95% of wheat landraces after replacing them with cultivars, however this percentage is very high in comparison to the results of the present study which was 62.2% (Table 9). Still, there are 215 different plant species accessions collected in Arcadia and preserved in Gene Banks (Table 2), highlighting the importance of ex-situ conservation. More than 128 accessions from Arcadia are kept in the working collection of the Agricultural University of Athens.

The number of people who continue to cultivate these landraces is small, and these people are aged and cultivate in a small acreage. Therefore, caution should be exerted in conserving landraces ex-situ and most importantly in-situ, by enhancing the young farmers' interest in them.

3.4. Landrace Naming as a Cultural Heritage among Different Countries

Similar meaning of names is given to landraces by the farmers in different countries. Landraces with similar agronomic type as “Trimini” or “Dimini” (Table 2) have been also found in Italy registered as a conservation variety under the name “Timilia Reste Nere” (syn. “Triminia” or “Trimini”) [118]. Additionally, “Ruscia” [119] (name of a Sicilian landrace) and “Russias” [46–48] (name of a Greek landrace) emphasize a similar naming practice and cultural heritage among different countries. Concerning vegetables, the Greek tomato landrace “Voidokardia” has the same name meaning, with the “Cuore di bue” Italian heirloom landrace (Table 3) [68]. Fig tree names reported in Arcadia have similarities with those in Spain, and these trees are named using the color of their fruits or their taste [120], as it also happens in Greece. Whether genetic similarity also exists between these varieties can be studied by using both morphological and molecular markers with genetic material from various countries [64,66].

Exchanging seeds was a common practice for farmers since the old times, usually in small distances, while the germplasm exchange among farmers between different state borders was enabled by trade, migration, and explorations [121]. In this context, the study of the genetic relation among these similarly named landraces would be essential for their origin, as it would help in understanding how genetic materials of the same origin changed under the effect of adaptation to different environmental conditions and farmer interference.

3.5. Landrace Abandonment and Proposals for Promotion and Conservation

As mentioned previously, since the 1950s many fields of Arcadia cropped with cereals and pulses changed to arboriculture [90]. Since then, as also mentioned by locals, many reasons have led to the abandonment of agriculture in mountainous villages. The modern agricultural equipment is not suitable for terrace fields cultivation to reduce the labor cost. Additionally, the traditional landraces are not as productive as the genetically bred ones, resulting in large production costs and the abandonment of cultivation in these areas. In this context, locals turned for their income to winter tourism [122,123] and/or employment by the factory of the Public Power Corporation S.A. which provides many jobs, mostly in Southern Arcadia [124].

The number of collected landraces showed a tendency to increase with altitude as was also observed for semi-mountainous compared to lowland areas in Lefkada [17]. Even though population was related to landrace number in other studies such as in Hammer and Laghetti [125] in our study, it was not observed. The difference of Arcadia and the previously mentioned studies is that the altitudes in the visited villages reach up to 1220 m above sea level. In these climatic conditions, it is difficult for several commercial cultivars to survive, or these villages are inhabited by people who keep the old seeds (elder population). Joshi and Witcombe [126] also highlighted that in high altitude, landraces are widely cultivated in Nepal. Giupponi et al. [13] analyzing the distribution of landraces to both altitude and latitude, showing that hilly and sub-mountainous areas are niches of landrace biodiversity. These references are in line with what was found in the present study and highlight the importance of mountainous areas as hotspots of landrace biodiversity.

Arcadian villages maintain a significant level of landrace biodiversity, both for cereals, as well as for legume and vegetable landraces, especially those located in higher altitudes, as also reported in other studies [13,126]. Landraces tend to be cultivated in marginal areas that modern cultivars are not. Since landraces are already mainly commercialized in local markets [127], they could benefit also from tourism, and specifically through agronomic and/or gastronomic tourism. Arcadia has the potential to be a touristic destination by including these types of tourism [128,129].

Furthermore, local festivals and fairs and best product contests have positive impact on in-situ conservation [127]. Raggi [127] highlighted that promotion was the most important factor increasing the added value of landraces, and that landrace grown in gardens, such as vegetables, present a high added value when managed by farmer consortia. Utilizing PDO (Protected Designation of Origin) and PGI (Protected Geographic Indication) quality schemes, European farmers can add premium quality signs to their products. Arcadian products can and already have been benefited by these schemes, as has happened with wine (Mantineia PDO, PGI Arcadia, and PGI Tegea) [5]. These trademarks can also be used for added value in cereals, pulses, and vegetables to increase their price and surpass the high production cost [130]. Accessibility of registered landrace material is also a problem in many states of the European Union because of the strict legislation rules concerning landrace registration in the National Catalogues [127].

Regarding the landraces that are not cultivated any more in Arcadia, such as several wheat landraces or “Kremasto” maize, these could be reintroduced from Gene Banks if seeds from Arcadia have been conserved ex-situ. Considering that elders usually possess the knowledge of landrace cultivation, they should pass this knowledge and genetic material to younger farmers, who nevertheless should have reasons to continue conserving these landraces [16,17] by making an income from them [130].

4. Conclusions

A significant number of accessions were collected from Arcadia. Cereals and vegetable biodiversity remains high, while a great variability regarding the different names of grapevine and fruit and nut tree local varieties was recorded. Genetic erosion, both in species and landraces, has been observed mostly for legumes and less for cereals when we compare accessions collected in 1942 to those collected in our study. On the contrary,

vegetable landrace cultivation was favored after WWII due to the availability of irrigation. The use of similar names in landraces in different areas or even countries is a challenging research area to reveal genetic relations in the context of their evolution and the related farmers' practices (i.e., genetic material exchange). The number of landraces collected was related to the village's altitude, highlighting mountainous regions as niches of landrace biodiversity and their adaptation to high altitude climates. The farmers in Arcadia highlighted the mechanization of agriculture, migration, and other sources of inhabitants' occupation as causes for landrace abandonment. As the landraces are conserved mostly by elderly people, their genetic erosion is expected to increase. However, gastronomic and agro-tourism, along with the European Union trademarks and national legislation improvement regarding landrace registration, can help Arcadians to continue cultivating crop landraces, perennial fruit trees, and particularly grapevine local varieties to support their on-farm conservation.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/d13110558/s1>, Table S1. The Agricultural University of Athens missions in Arcadia, Villages, collectors, samples per mission and botanical families of the samples; Table S2. Cereal landrace names, their explanations and occurrence from 1914 to 2021; Table S3. Legume landrace names, their explanations and occurrence from 1914 to 2021.

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