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Floristic Inventory of Ethnobotanically Important Halophytes of North-Western Mediterranean Coastal Brackish Areas, Tuscany, Italy

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Abstract: Plants have always been used by people for multiple purposes, but over the centuries knowledge of useful plants has largely been lost. Through ethnobotanical studies it is possible to retrieve information on the uses of plants and renew the ancient attention to plants which could be useful to apply in modern applications. In this context, the ethnobotanical use of halophytes has not been explored in depth. The present study focused on the flora of two brackish areas of the north-western Mediterranean sited in Tuscany, Italy. This research aimed to identify the halophyte species of ethnobotanical interest and create a relative map database of the study areas. The floristic list of the two areas, including 78 halophyte and non-halophyte species, was created following periodic field sampling, localization of the species by GPS, and taxonomic identification. The ethnobotanical information was acquired through a bibliographic survey. Botanical, geographic, and ethnobotanical information was filed and included in floristic maps produced using the free Open Source QGIS software. Of the total wild species surveyed, 50% were halophytes with ethnobotanical properties, with a predominance for medicinal ones. Some of them are the subject of numerous studies today such as those on antioxidants. Both investigated areas showed a high floristic and ethnobotanical value. This makes them interesting as potential germplasm banks to be used in various application contexts of ethnobotany.

Keywords: alimurgical; floristic map; folk medicine; GIS; halotolerant species; plants database; salt marshes

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1. Introduction

Ethnobotany can be defined as the study of the numerous relationships between plants and people of certain places and cultures. It is a multidisciplinary science concerned more than any other with ensuring the conservation and protection of data on the potentially multiple practical uses of a region's plants. The knowledge obtained from ethnobotanical study has both a high cultural value, as a historical memory of rural civilization, and a scientific, social, and economic value due to its potential in various fields of application [1].

Even today, many communities depend on the medicinal properties of some wild plants for their health, and/or on their collection and conservation for nutritional purposes. In most countries, however, these are mostly rural communities which, thanks to the maintenance of a peculiar relationship with plants and the custody of millenary customs and traditions, assume the important role of a cultural bridge between the past and present and an inexhaustible source of knowledge for the new generations of these regions [2].

In more developed and modernized societies, especially in the West, this bond with the traditional uses of wild plants has increasingly diminished over time, drastically reducing the knowledge handed down and increasing the risk that a cultural heritage of such great importance could be inexorably lost.

The gradual decline of the baggage of such knowledge in Western countries is closely connected to the development of activities such as large-scale intensive agriculture responsible, among other things, for the drastic reduction in the biodiversity of food plants and for a progressive genetic erosion [3]. The diffusion and strong publicity of a few selected products, qualitatively of lesser value, creates a cultural homogenization and levelling in populations, which leads to a decrease in interest in the traditional uses of plant species [4].

This awareness has contributed, especially in recent decades, to an intensification of efforts to develop studies and projects aimed at preserving traditional knowledge as much as possible [5]. The many popular uses of plants, especially in the fields of medicine and the food industry, can stimulate interest in new and different needs of the modern market [6]. In recent years a great deal of research has been conducted on so-called "functional foods" and on "nutraceuticals" whose role has been well recognized in relation to health promotion, disease risk reduction, and healthcare cost reduction [7–9].

On another note, it should be considered that global climate change is increasing at an alarming rate, becoming a source of serious problems as well for food security. Among these threats, soil salinization will be an increasingly widespread phenomenon in every part of the earth [10]. It will therefore be essential to find new ways and new resources among the most halotolerant species to ensure food and health security for the world population.

The amount of information available in the literature on the use and potential applications of spontaneous plants is quite large when referring to terrestrial glycophytes (plants that are sensitive to high concentrations of salts in the soil), while it is still rather limited on plants growing in wetlands and particularly in brackish areas, despite their significant role in the daily life of populations living within and around this ecosystem [11].

Research on halophytes, plants that have naturally adapted to living and reproducing in environments with high concentrations of salts such as salt marshes, is still very limited. Although the value of halophytes is no longer completely unknown both in the field of cash crops for food, feed, biofuels, oils, and in that of phytoremediation of soils from salts or heavy metals [12,13], very few species are used. Their use is even more limited in other fields, such as medicine, despite their recognized potential as a source of important compounds such as flavonoids, terpenoids, tannins, alkaloids, etc. [14,15].

The objective of this study was to create a digital database of halophytes of ethnobotanical interest. This approach can contribute to the acquisition of as much data as possible on the virtues and possible uses of these plant species as well as on the sites that naturally offer the most suitable geomorphological and climatic conditions for their development and diffusion. The research focused on some brackish wetlands of the Mediterranean basin located along the northern Italian coast and colonized by large communities of halophytic herbaceous and shrub species of potential ethnobotanical interest [16,17].

The geographic and ethnobotanical data collected were then used to create a digital cartographic database, which can be constantly implemented over time and used by public and private bodies as a support tool for researching and monitoring the flora of brackish areas.

The data collected and the digital database will be an important information resource for implementing knowledge and stimulating new or lost interest in the potential and uses of halophytes even in the more developed western regions. The information will also be able to be used in future research or in projects already underway, as in the case of the European project HaloFarMs (https://mel.cgiar.org/projects/halofarms, accessed on 17 September 2022) which aims to optimize innovative and sustainable agricultural and production systems in the Mediterranean region by exploiting the ecological and economic potential of halophytes.

2. Materials and Methods

2.1. Study Area

The study area includes two distinct and separated salt marshes located inside the Regional Park of Migliarino, Massaciuccoli, and San Rossore (Tuscany, Italy). The entire Park is along the Tyrrhenian coast of northwestern Tuscany, Italy, and located, from a geomorphological point of view, in an alluvial plain formed by Quaternary sediments.

The two study brackish areas occupy a total of about 320 hectares of the park surface and are here named Lame and Galanchio (Figure 1).

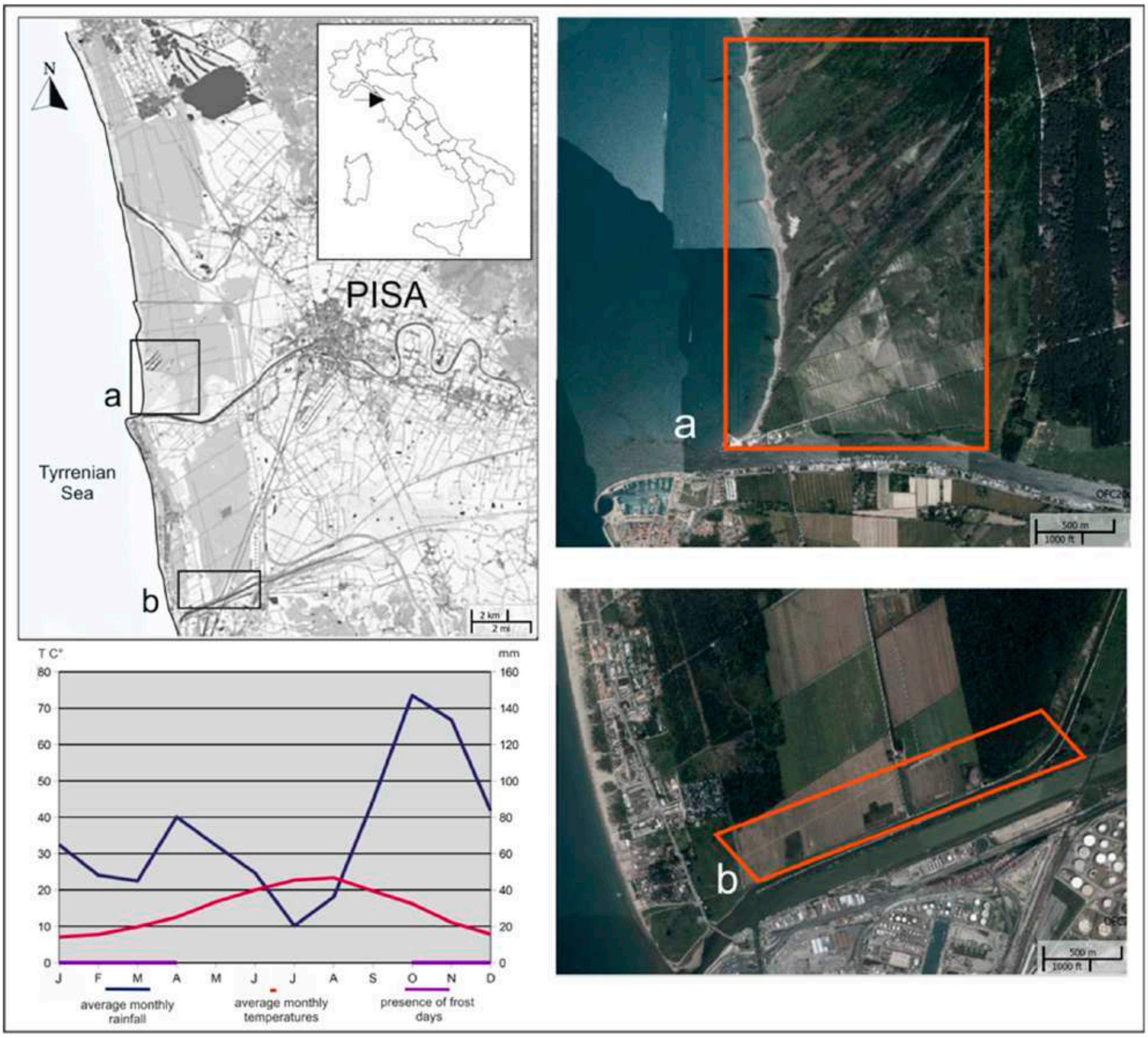

Figure 1. Top left—Geographical localization of study areas. **Bottom left**—Walter–Lieth diagram of area (2011–2021). **Right**—the two brackish areas investigated: (**a**) Lame, (**b**) Galanchio.

The climate of the area, according to the Pesaresi [18], can be included in the Mediterranean macrobioclimate, mesomediterranean thermotype, subhumid lower shadow type. The average annual temperature, extrapolated from the historical archives of the Bocca d'Arno (PI) station for the period 2011–2021, is close to 15.7 °C with maximum peaks ranging between 31 and 34.5 °C in the summer period when rainfall instead touches minimum levels, causing drought and a water deficit (http://www.sir.toscana.it/consistenza-rete, accessed on 17 september 2022).

The two brackish areas have loamy–clayey soils whose salinity is strongly influenced by the proximity of the sea and by a pronounced seasonal hydromorphism. Soil electrical conductivity (EC), measured with a portable electromagnetic induction device Geonics EM38®, revealed that average soil salinity ranges between 4 and 17 mS/cm for the Lame area and from 0.2 to 28 mS/cm for Galanchio in the autumn and summer period, respectively.

The area called Lame (Figure 2), located in the San Rossore Estate on the right bank of the Arno River, is part of a larger wetland, included in the Natura 2000 Network, which represents the largest brackish complex of the Pisan coast [19]. It lies between 43°41′08.1 N and 10°17′23.9 E, covering about 250 hectares at an altitude ranging from −0.1 m to 0.8 m a.s.l. This portion is mainly flat due to the hydraulic reclamation works carried out in the early 1900s and is also the part where there is the highest concentration of salt in the ground.

Figure 2. Details of the brackish wetland area Lame, Regional Park of Migliarino, Massaciuccoli, and San Rossore (Tuscany, Italy).

The area called Galanchio (Figure 3) is in the Tombolo Estate on the right bank of the Scolmatore canal, near the border between the provinces of Pisa and Livorno at the southern border of the Migliarino San Rossore Massaciuccoli Regional Park. The study area covers about 70 hectares, which are located between the midpoint of longitude 43°35′27.6 N and latitude 10°18′58.3″ E at an altitude ranging from −0.5 m to 1 m a.s.l. The entire brackish area can be divided into two subareas: an area closer to the sea, mainly managed as agricultural land, and one more distant from the coast located in the Cornacchiaia Nature Reserve, better preserved and with high naturalistic value due to the presence of rare vegetation associations [20].

Figure 3. Details of the brackish wetland area Galanchio, Regional Park of Migliarino, Massaciuccoli and San Rossore (Tuscany, Italy).

2.2. Data Collection and Processing

Accurate bibliographic research was first conducted using keywords such as "halophytes", "ethnobotany", and "salt marshes", aimed at identifying the main species of halophytes distributed on the Italian territory and which could also have been present in the two salt marshes under study. The collection of this information was also useful to evaluate the possible ethnobotanical interest of some local halophytes at least for a part of the human population.

The floristic surveys of the two salt marshes, were carried out on the entire surface of both study areas, between April 2021 and April 2022, on a weekly basis during the spring–summer period and monthly during the autumn period. Global Positioning System (GPS) coordinates (GPS Test App., Galaxy XCover 4s, accuracy ±5 m) were determined and saved to georeference the distribution of each plant species on a digital map. On the map, the species are identified by a dot, corresponding to its presence in a square of 50 m of side inserted in a grid referred to WGS84 (EPGS:4326) standard. The species found were identified with the dichotomous key of Flora d'Italia [21] updating the nomenclature according to Bartolucci et al. (2018) [22] and subsequent updates summarized in the Portal to the Flora of Italy [23]. The plant species surveyed, identified by the binomial and the biological and chorological forms, were collected in a floristic list, divided by families.

The distinction between halophytic and non-halophytic species was made using the eHaloph digital database [24] which, based on the work of Aronson (1989) [25], collects more than 1500 species with a salt tolerance equivalent to about 80 mM NaCl (conductivity of 7.8 dS m^{-1}) or superior.

The halophytes surveyed were divided into Euhalophytes (true halophytes or extreme halophytes) and Myohalophytes (less tolerant), according to the classification of Chapman (1942) [26]. Based on the higher salinity levels proposed by Flowers and Colmar (2008) [27] to distinguish the two categories, together with information from the literature for each species and personal observations in the field, we assumed that:

- Euhalophytes are the species that complete their life cycle in environments with permanently high salinity, even similar to that of seawater (50 dS m^{-1}) and in any case with values close to or above 200 mM NaCl (about 19.6 dS m^{-1}) at least for a period of the year.
- Myohalophytes grow and reproduce in substrates with salinity values below 200 mM.

For each halophyte, references to studies conducted under controlled conditions were also included, together with the respective salt concentrations used.

The floristic map was created using QGIS software (QGIS Association. http://www.qgis.org) and referred to the Web Map Service of the Tuscany Region (https://www.regione.toscana.it/-/geoscopio-wms, accessed on 28 August 2022). The mapping was focused on the collection of plant distributional data obtained through field surveys.

Using the QGIS application, the distribution in the study areas of halophytes of ethnobotanical interest was represented using georeferenced points. Each map was accompanied by a short description of the species about the main systematic, botanical, and ethnobotanical characteristics, the reference habitats following the Interpretation Manual of European Union Habitats, version EUR 28 (https://eunis.eea.europa.eu/references/2435, accessed on 28 August 2022) and the European distribution according to the Euro + Med PlantBase online database (https://www.emplantbase.org/home.html, accessed on 28 August 2022).

Drone aerial shots were used as a support to identify the distribution of plant communities in certain areas of the Lame area.

3. Results

A comprehensive floristic checklist of the plant taxa of the study areas is presented in Appendix A (Table A1). Within the checklist, the families and species are organized alphabetically and accompanied by a biological and chorological form and an indication of the collection site. According to our results, the two areas hosted a total of 78 species belonging to 26 families and 56 genera. Of these species, 71 were registered in the Lame (L) and 43 in Galanchio area (G). The dominant families were Poaceae with 17 species, followed by Cyperaceae and Amaranthaceae with 13 and 9 species, respectively. Some of the species found were peculiar to one or the other area, probably due to the different ecological and anthropic impact characteristics of the two salt marshes. Specifically, 7 species were peculiar to Galanchio and 35 to Lame. Among these species, *Soda inermis*, although also reported in the Lame [28] were currently present only in Galanchio area.

According to the salt-tolerant plant database eHaloph [24], 47 of the species surveyed were classified as halophytes. These were collected in alphabetical order and are presented in Table 1 together with location, maximum salinity tested in experimental studies with related bibliographic references, and different sectors of use. Forty-one halophytes were found to be present in the Lame and 38 in Galanchio. In Table 1 a distinction between Euhalophytes and Myohalophytes is also shown. A total of 13 halophytes were classified as Euhalophytes and consequently 34 as Myohalophytes. Of the total halophytic species, 39 were of ethnobotanical interest (11 Euhalophytes and 28 Myohalophytes) with an established traditional use which could be food, medicinal, or artisanal. Most of the species are used in at least two sectors with a clear prevalence in the medicinal field (Tables 1 and 2) in which young shoots and leaves of species are mostly used.

Table 1. List of 47 halophytes recorded in the salt marshes of Galanchio and Lame. For each species the location, the maximum salinity tested in experimental studies whose references are indicated in brackets, and the different fields of use are indicated. (L = Lame; G = Galanchio; SW = sea water, about 600 mM.

Species	Location	Salinity (mM)	Use		
			Food	Medicinal	Artisanal
Euhalophyte					
Halimione portulacoides Aellen	G	1000 [29,30]	x	x	n.a.
Juncus acutus L.	L/G	SW [29]	n.a.	x	x
Juncus maritimus Lam.	L/G	SW [29,31]	n.a.	x	x
Limbarda crithmoides (L.) Dumort.	L/G	SW [32]	x	x	n.a.
Limonium narbonense Mill.	L/G	800 [33,34]	x	x	n.a.
Puccinellia festuciformis (Host) Parl.	G	193 [35,36]	n.a.	n.a.	n.a.
Salicornia perennans Willd.	L/G	SW [37–39]	x	x	x
Salicornia perennis Mill.	L/G	SW [40,41]	x	n.a.	x
Soda inermis Fourr.	G	141 [42]	x	x	x
Sporobolus aculeatus (L.) P.M. Peterson	L/G	180 [20]	n.a.	n.a.	n.a.
Sporobolus virginicus (L.) Kunth	L/G	450 [29,43,44]	n.a.	n.a.	n.a.
Suaeda maritima (L.) Dumort.	L/G	486 [45,46]	x	x	n.a.
Suaeda vera J.F. Gmel.	L/G	SW [29,35,47,48]	x	x	x
Myohalophyte					
Aeluropus littoralis (Gouan) Parl.	L/G	800 [29,49]	n.a.	x	n.a.
Artemisia caerulescens L.	L/G	250 [50,51]	x	x	n.a.
Arundo donax L.	L/G	160 [52]	n.a.	x	x
Atriplex littoralis L.	L/G	SW [53]	x	x	n.a.
Atriplex patula L.	L	720 [54,55]	x	x	n.a.

Table 1. *Cont.*

Species	Location	Salinity (mM)	Use Food	Medicinal	Artisanal
Atriplex prostrata Boucher ex DC.	L/G	137 [56]	x	x	n.a.
Bolboschoenus maritimus (L.) Palla	L/G	417 [57]	x	x	x
Cynodon dactylon (L.) Pers.	L/G	400 [58]	x	x	n.a.
Eleocharis palustris (L.) Roem. and Schult.	L	200 [59]	x	n.a.	n.a.
Elymus repens (L.) Gould	L/G	400 [60,61]	x	x	n.a.
Galatella tripolium (L.) Galasso, Bartolucci and Ardenghi	L/G	450 [62,63]	x	x	n.a.
Hordeum marinum Huds.	L/G	450 [64–66]	n.a.	n.a.	n.a.
Imperata cylindrica (L.) P. Beauv.	L	200 [67]	x	x	x
Juncus articulatus L.	L/G	100 [68]	n.a.	n.a.	x
Juncus gerardi Loisel.	L/G	310 [69]	n.a.	x	n.a.
Lolium multiflorum Lam.	L/G	120 [70]	n.a.	x	n.a.
Lotus tenuis Waldst. Et Kit. ex Willd.	L/G	450 [71,72]	n.a.	x	n.a.
Parapholis filiformis (Roth) C.E. Hubb.	L/G	340 [73]	n.a.	n.a.	n.a.
Parapholis incurva (L.) C.E. Hubb.	L	182 [74]	n.a.	n.a.	n.a.
Plantago coronopus L.	L/G	800 [75–77]	x	x	n.a.
Polypogon monspeliensis (L.) Desf.	L/G	400 [78–80]	x	x	n.a.
Portulaca oleracea L.	G	200 [52,81]	x	x	n.a.
Puccinellia distans (Jacq.) Parl.	L	200 [82–85]	x	n.a.	n.a.
Schoenoplectus lacustris (L.) Palla	L	300 [86,87]	n.a.	n.a.	x
Schoenoplectus pungens (Vahl) Palla	L	500 [88]	x	n.a.	x
Schoenus nigricans L.	L	139 [89,90]	n.a.	x	x
Scirpoides holoschoenus (L.)	L/G	240 [91]	n.a.	x	n.a.
Spergularia marina (L.) Besser	L/G	160 [92,93]	x	x	n.a.
Spergularia media (L.) C. Presl	L/G	160 [94]	n.a.	x	n.a.
Sporobolus pumilus (Roth) P.M. Peterson and Saarela	L/G	500 [95–97]	n.a.	n.a.	n.a.
Tamarix gallica L.	L/G	600 [98]	n.a.	x	x
Thinopyrum acutum (DC.) Banfi	G	450 [63,78]	n.a.	n.a.	n.a.
Trifolium resupinatum L.	L	100 [99,100]	n.a.	x	n.a.
Trifolium squamosum L.	G	100 [101]	n.a.	x	n.a.

x = data available; n.a. = data not available.

The digital floristic maps produced using QGIS show the presence and distribution of 39 ethnobotanically important halophytes found in the study areas.

Below is an example (Figure 4) of a detail of the maps with a link to the descriptive cards that can be opened and consulted in the Supplementary Material.

Table 2. Description of the potential utilization and properties of 39 ethnobotanically significant halophytes surveyed in the study areas of Galanchio and Lame. (references = studies where the information was obtained; n.a. = data not available; ° euhalophyte species).

Species	Properties	Part of Plants Used	Main Components	Ethnobotanical Use	References
Aeluropus littoralis (Gouan) Parl.	Astringent, diaphoretic	Leaves	Phenols, alkaloids, flavonoids, saponins, tannins, terpenoids	Fodder Folk medicine (diarrhea, fevers)	[102–105]
Artemisia caerulescens L.	Anthelmintic, tonic, stomatal, eupeptic, antibacterial, cytotoxic, antifungal	Flowering tops, leaves	Santonin, essential oil (αthujone, βthujone, camphor, borneol, terpineol, pcymene, αterpineol)	Folk medicine (intestinal parasites, gastric, liver disorders) Liquor	[106–113]
Arundo donax L.	Hypotensive, antispasmodic, emetic, diaphoretic, diuretic, emollient, antimicrobial, antioxidant, antipyretic, antitumor, hemostats	Roots, culms, leaves, rhizome	Bitter substances, alkaloids, potassium salts, resins	Folk medicine (urinary disorders, vasopressor, uterine stimulation, toothache, osteoarthritis, stimulate menstrual cycle, cancer, dropsy, flu, cold, bronchitis, edema, disrupt the milky whip, skin problems) Artisanal Paper production Musical instruments	[114–117]
Atriplex littoralis L.	Antioxidant	Leaves, unripe fruits, sprouts, shoots	Phenols, flavonoids (atriplexin, quercetin)	Food Folk medicine (stomach acidity, diabetes)	[118–120]
Atriplex patula L.	Antioxidant	Young shoots, leaves, buds, flowers, seeds	Phytoecdysteroids, flavonoids, triterpenoid saponin, coumarins, alkaloids	Food Folk medicine (neurological, mental disorders) Ethnoveterinary (parasitic diseases, wounds, scabies) Phytoremediation	[119,121–125]
Atriplex prostrata Boucher ex DC.	Anti-inflammatory, antioxidant	Young leaves, whole plant	Phenols, polyphenols	Food Folk medicine	[103,126,127]
Bolboschoenus maritimus (L.) Palla	Astringent, diuretic, antioxidant	Rhizomes, seeds, sprouts, root	Alkaloids, phenols, polyphenols	Food Folk medicine (abdominal, vaginal tumors) Insecticide Artisanal	[126,128–132]

Table 2. *Cont.*

Species	Properties	Part of Plants Used	Main Components	Ethnobotanical Use	References
Cynodon dactylon (L.) Pers.	Diuretic, depurative, antihemorrhagic, antiseptic, antioxidant, anti-infiammatory, immunostimulant	Root, whole plant, shoots, rhizomes,	Fructans, mucilage, polyols, saponins, mineral salts, essential oil, phenol, alkaloids, tannins, flavonoids	Folk medicine (urinary system problems, sore throats, abdominal pain, treat stomach aches, kidney diseases, skin problems, kidney stones expulsion, menstrual cramps, rheumatism, diabetes, dropsy, syphilis, hysteria, epilepsy, chronic diarrhea, dysentery, tumors, cough, headache, hypertension, wounds, burns) Brewing Food Fodder Veterinary	[7,115,117,133–139]
Eleocharis palustris (L.) Roem. and Schult.	n.a.	Lymph	n.a.	Food Ornamental	[128,140]
Elymus repens (L.) Gould	Diuretic, soothing, emollient, antioxidant, hypoglycemic, hypolipidemic, ani-inflammatory	Rhizome, root, seeds	Polysaccharides, quercetin, luteolin glycosides, polyphenols, flavones, phenolic glucosides, essential oil, alcohols, hydroxycinnamic esters, fatty acids.	Food Folk medicine (nephritis, urethritis, calm pain, spasms in the urinary tract, enuresis, incontinence, prostatic diseases, rheumatism, urinary stones, cystitis)	[138,141–143]
Galatella tripolium (L.) Galasso, Bartolucci and Ardenghi	Antioxidant, anti-infiammatory, ophthalmic	Leaves, roots	Minerals, flavonoids, caffeoyl esters, polyphenols, hydrocinnamic acids, matricariol	Food Folk medicine (diabetes, eye disease)	[144–150]
°*Halimione portulacoides* Aellen	Antioxidant, antidiabetic, antifungal, antimicrobial	Leaves	Tannins, flavonoids, flavonoid glycosides, saponins, alkaloids	Food Folk medicine (diabetes, blood purification, fever, jaundice and liver disease, thyroid disorder)	[119,151–153]

Table 2. *Cont.*

Species	Properties	Part of Plants Used	Main Components	Ethnobotanical Use	References
Imperata cylindrica (L.) P. Beauv.	Moisturizing, emollient, diuretic, antihemorrhagic, febrifuge, anti-inflammatory, neuroprotective, vasodilatory	Roots, young shoots, rhizome, leaves	Saponins, glycosides, coumarins, flavonoids, phenols	Folk medicine (ulcers, infectious diseases, rheumatism, jaundice, emesis, hemorrhage, fever) Food Ornamental Paper production Fiber	[115,148,154–158]
° *Juncus acutus* L.	Diuretic, sedative, anti-inflammatory, cytotoxic, antiacetylcholinesterase, antioxidant	Culms, rhizome, fruits	Coumarins, carotenoids, phenanthrenoids (juncusol)	Ornamental Artisan Paper production Food Folk medicine (colic, cold, genitourinary diseases)	[103,105,146,159–163]
Juncus articulatus L.	n.a.	Culms	n.a.	Artisanal	[163]
Juncus gerardi Loisel.	Antioxidant, cytotoxic, antibacterial	Whole plant	Flavonoids, tannins, polyphenols, phenanthrenes (juncusol, jinflexin B)	Medicinal	[146,164,165]
° *Juncus maritimus* Lam.	Analgesics, antiseptics, anti-inflammatory	Fruits, rhizome	Flavonoids, phenanthrenoids, phenolic compounds, saponins	Ornamental Phytodepuration Artisanal Folk medicine (digestive disorders, diabetes, insomnia, urinary, reproductive tract infections, injuries, wounds, skin diseases)	[103,105,146,166,167]
° *Limbarda crithmoides* (L.) Dumort.	Diuretic, anti-inflammatory, astringent, tonic	Young shoots, leaves, roots, flowering stems	Iodine, terpenes, lipid (linalool, fatty acid), flavanols, thymol derivatives, carvacrol	Food Liquor Folk medicine (bronchitis, tuberculosis, anemia, malaria symptoms, urinary diseases)	[103,115,161,168–171]

Table 2. *Cont.*

Species	Properties	Part of Plants Used	Main Components	Ethnobotanical Use	References
° *Limonium narbonense* Mill.	Antioxidant, antibacterial, antiviral, cytotoxic, astringent, hemostatic	Leaves, roots, flowers	Polyphenols (myricetin, a. gallicum, kaempferol), essential oil	Food Folk medicine (cancer, colic, menstrual diseases, rheumatic cardiac disorders, pulmonary, respiratory diseases) Ornamental	[146,172–174]
Lolium multiflorum Lam.	Antioxidant, sedative, anti-inflammatory, antiseptic	Seeds, whole plant, shoots, roots	Phenolic a., flavonoids, benzoic acids, cinnamic acids	Food Folk medicine (kidney problems) Veterinary	[135,175,176]
Lotus tenuis Waldst. Et Kit. ex Willd.	Sedative, anti- inflammatory, cytotoxic	Whole plant	Alkaloids, phenols, flavonoids, sterols, saponins, tannins, cardiac glycosides, carbohydrates	Feed Veterinary Folk medicine	[103,177–179]
Plantago coronopus L.	Analgesic, anti-inflammatory, antipyretic, antitumor, emollient, tonic, astringent, laxative, cytotoxic, antioxidant	Leaves, roots	Vitamins A, C, K, minerals, iridoid glycoside (aucubin), flavonoids, phenolic acid, luteolin	Food Folk medicine (respiratory system disease, skin problem, cancer, colds, conjunctivitis, arthritis, hepatic stasis)	[76,180,181]
Polypogon monspeliensis (L.) Desf.	Antioxidant, cytotoxic, antimicrobial, antiviral, hepatoprotective	Whole plant, seeds	alkaloids, flavonoids, phenols, steroids, terpenoids, saponins, tannins and coumarin	Feed Food Folk medicine (heart palpitations) Ornamental	[115,140,182,183]
Portulaca oleracea L.	Vermifuge, diuretic, anaphrodisiac, anti-inflammatory, antidiabetic, antioxidant, antibacterial	Leaves, young shoots, flower, seeds, fruits	Phenolic compounds	Food Folk medicine (cough, gonorrhea, blood purification, toothache, stomachache, liver, to prevent heart disease, cancer, weight loss, gastric, bone diseases, abscesses, skin diseases) Feed Magic	[7,114,135,154,182, 184–188]

Table 2. *Cont.*

Species	Properties	Part of Plants Used	Main Components	Ethnobotanical Use	References
Puccinellia distans (Jacq.) Parl.	n.a.	Whole plant, seeds	n.a.	Feed Food Phytoremediation	[189–191]
° *Salicornia perennans* Willd.	Antioxidant, diuretic, tonic, antidiabetic, cytotoxic	Young shoots, seeds, leaves	Ascorbic, dehydroascorbic acid, carotenoids, polyphenol, linoleic, oleic acids, palmitic, stearic acids, saponins, protein, fatty acids, selenium, oxalate, vitamin C, octacosanol	Food Folk medicine (diabetes, dropsy, cholesterol, obesity, cancer, central nervous system paralysis) Soda production	[115,121,146,153, 192–201]
° *Salicornia perennis* Mill.	Antioxidant	Young shoots, seeds, leaves	Minerals (Na, K, Mg, Ca, P), ascorbic acid, chlorophyll, carotene, phenols	Food Soda production	[121,142,194,202, 203]
Schoenoplectus lacustris (L.) Palla	Diuretic, Astringent, antibacterial	Culms	Flavonoids, tannins, saponins	Fiber Food Folk medicine	[128,204]
Schoenoplectus pungnes (Vahl) Palla	n.a.	Culms, rhizome, roots	n.a.	Artisanal Food Folk medicine	[88,128,140,205]
Schoenus nigricans L.	Antioxidant	Flowers, culms	Flavonoids, stilbenes	Artisanal Folk medicine (burns)	[128,206,207]
Scirpoides holoschoenus (L.)	Diuretic, hepatoprotective, antioxidant, antimicrobial	Roots, rhizome	Polyphenols, phenolic acids, flavonoids, phytosterols	Folk medicine (toothache, normal digestion, normal bile, liver functions)	[208,209]
° *Soda inermis* Fourr.	Diuretic, ani-inflammatory	Young shoots, adult plant	Alkaloids, minerals	Food Soda production Folk medicine (hypertension, kidney stones expulsion, constipation, Alzheimer's disease)	[17,121,187,202,210, 211]
Spergularia marina (L.) Besser	Anti-inflammatory, antioxidant	Aerial parts	Amino acids, vitamins, minerals, phenols, saponins, glycosides, flavonoids, tannins	Food Folk medicine (kidney stones expulsion, bladder infections, dysuria, ephelides, genitourinary disease)	[103,212–214]

Table 2. *Cont.*

Species	Properties	Part of Plants Used	Main Components	Ethnobotanical Use	References
Spergularia media (L.) C. Presl	Emetic	Roots, aerial parts	Flavonoids	Folk medicine	[215,216]
° *Suaeda maritima* (L.) Dumort.	Antiviral, ani-inflammatory, antibacterial, immunostimulant, antioxidant	Leaves, seeds, young stems	Vitamins, a. fats, polyphenols, triterpenoids, sterols, essential oil, fiber, minerals	Food Soda production Folk medicine (hepatitis, rheumatism, paralysis, asthma, snakebite, skin diseases, ulcers)	[5,103,121,126,146, 217–220]
° *Suaeda vera* J. F. Gmel.	Hypoglycemic, antioxidant, emetic, antibacterial, anticancer	Whole plant, seeds, leaves, roots	Essential oils	Food Soda production Folk medicine (osteoarticular disorders, diabetes, liver diseases, ophthalmia, cholesterol) Dyeing	[103,115,126,221,222]
Tamarix gallica L.	Astringent, antidiarrheal, mild laxative, diuretic, antihemorrhagic, expectorant, antidiabetic, anthelmintic, antioxidant, anti-inflammatory, antibacterial	Galls, bark, manna, leaf	Tannins, polyphenols, alkaloid (tamarixin), phenolic acids, flavonoids, coumarins	Artisanal Folk medicine (diarrhea, dysentery, prophylaxis, remedy for malaria, liver diseases, cardiovascular disorders, gingivitis, hemorrhoids, rheumatism, leukoderma, spleen problems, eye diseases Dyeing Magic Ornamental	[103,160,200,223–226]
Trifolium resupinatum L.	Sedative, antioxidant	Flowers, leaves, seed	Isoflavones	Food (Timbrook) Feed Folk medicine (whooping cough, digestive disorders, constipation, liver disorders, obesity, skin sores	[227,228]
Trifolium squamosum L.	Diaphoretic	Whole plant, leaves, seed	Flavonoids, phenolic acid	Food (Timbrook) Folk medicine Feed	[227,228]

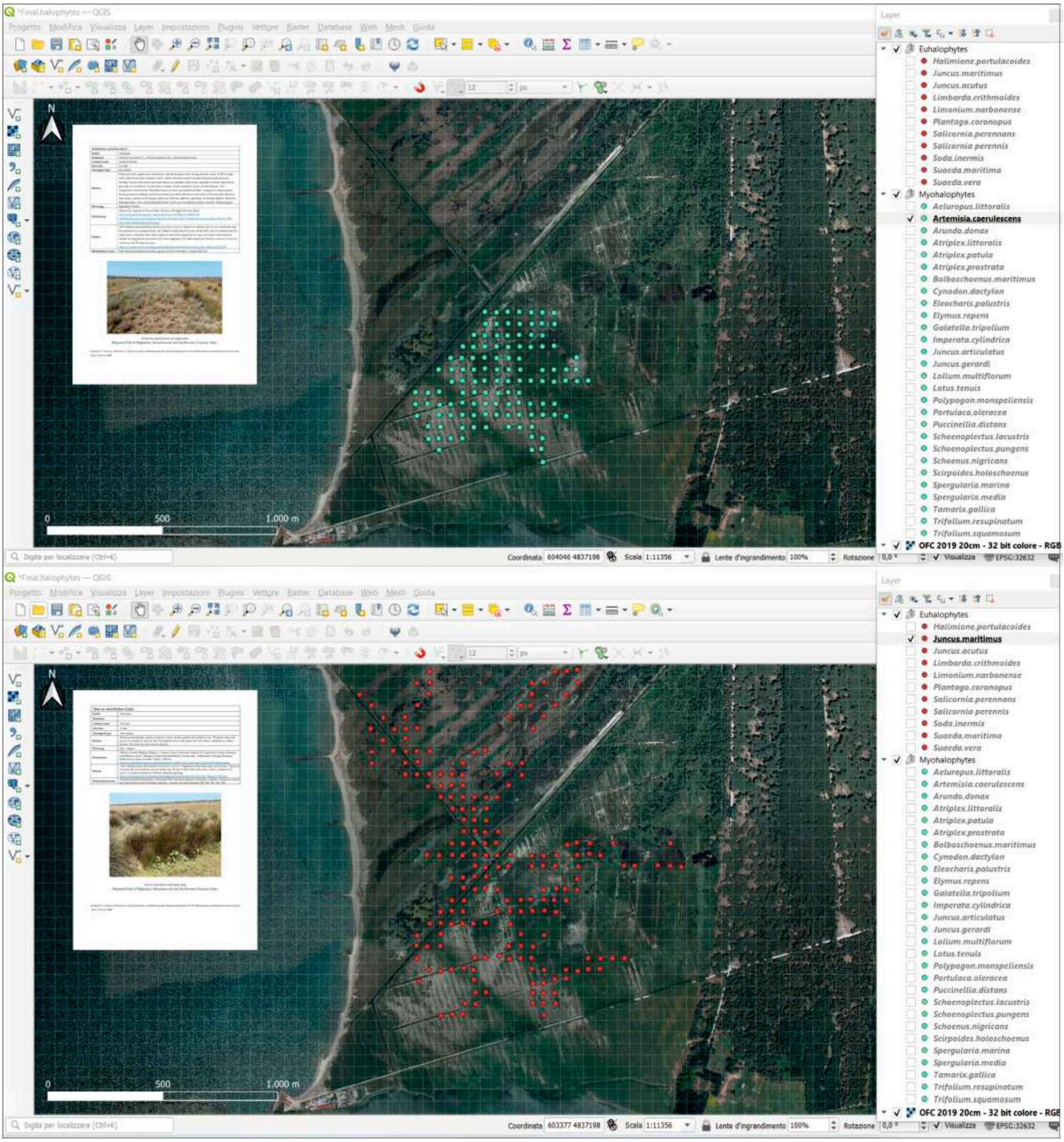

Figure 4. Example of the digital maps with the related data sheet accessible by link, referring to *Artemisia caerulescens* and *Juncus articulatus* and their distribution in the Lame area.

Each species is associated, in the map, with a different color based on its salinity tolerance. The red color refers to euhalophytes, and green color refers to the myohalophyes.

The drone shots highlighted in the Lame area a different arrangement of the halophytic communities in relation to the different altimetry (Figure 5).

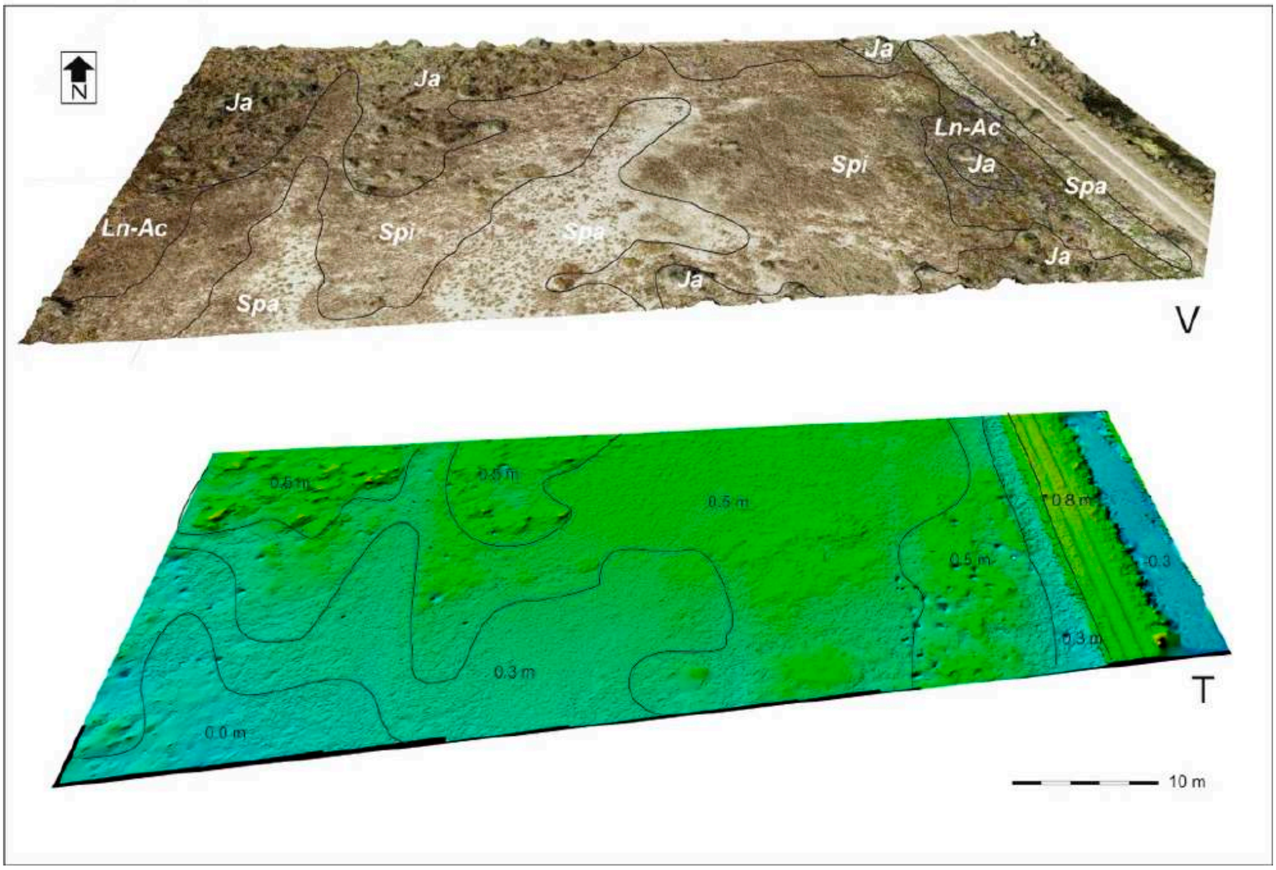

Figure 5. Different distribution of halophytic communities (V) in relation to the different altimetry (T) of the Lame area. *Ja*: *Juncus acutus*; *Spi*: *Salicornia perennis*; *Spa*: *Salicornia perennans*; *Ln-Ac*: *Limonium narbonense* and *Artemisia caerulescens*.

4. Discussion

The study documented and summarized the information on halophytes with ethnobotanical virtues found in the brackish coastal areas of northern Tuscany in the Mediterranean basin. The aim was to recover knowledge and renew interest in the use of these plants also in Western countries and in more modernized communities such as those in Europe.

The research conducted also allowed us to outline the ethnobotanical value of this type of environment and, therefore, its potential as a source of peculiar species and ecotypes to be used in various fields such as medicine, food, or crafts.

The investigated areas are transition environments between land and sea, characterized by a high salinity of the soils at least in the summer season when temperatures and light are also very intense while rainfall is scarce or nil [229]. These environmental factors are subject to profound variations during the year, so much so that, in the same areas, conditions of high aridity with deserted and brackish soils, and conditions of almost total submersion with evident large wetlands, can be detected. It is an environment, therefore, subject to rather drastic environmental changes where only very particular plants can survive and spread spontaneously. These plants are commonly known as halophytes and show physical characteristics and physiological adaptations capable of withstanding even drastic variations in the most typical environmental factors of these areas such as salinity levels and water supplies [230]. To these, however, can be added, as in the case of the study areas, the texture, and the morphology of the ground, as well as the presence or absence of wild and grazing animals [231]. All these factors induce the species to model their own morphophysiology and their life cycle but also their own development dynamics with the formation of diversified sequences and zoning accompanied by the presence of halophilic species peculiar to one or the other saline (three euhalophyte and three myohalophytes for Galanchio and nine myohalophytes for Lame—see Table 1).

The latter elements are particularly significant in the ecological differentiation and, therefore, also in the ethnobotanical value of the two areas that deserve greater attention and protection not only from a naturalistic point of view, but also as germplasm banks of local halophytic species with food or medicinal or other properties.

In this regard, it is also necessary to evaluate another important factor that has a profound impact on all natural environments and even more on critical ones such as salt marshes. We refer to anthropogenic pressure.

Between the two stations, the Lame area is the least affected by human activity, and this has helped to minimize the effects of grazing by ungulates above all, and to allow the development of an overall richer flora (71 species against 43 of Galanchio) and also of a greater number of halophytes of ethnobotanical use, some of which are peculiar to the area such as *Imperata cylindrica* used in various fields including the medical one for its antibacterial, antifebrile, hemostatic, but also tonic activity [155] or *Trifolium resupinatum* known as a forage plant but also for its antioxidant properties and its uses in folk medicine to treat whooping cough, digestive disorders, constipation, liver disorders, and as a sedative [227].

Due to the low anthropic impact, the area of the Lame also presents a defined vegetational zonation of halophytic phytocoenosis [232] not present in the Galanchio area and according to ground elevation differences (Figure 5). The analysis of these differences could be useful in projects of cultivation of ethnobotanical species in a natural context. Limiting our attention to only the halophytes of greatest ethnobotanical interest, it can be noted that the lowest point of each depression, where states of complete submersion can occur in the rainy period (autumn for our latitudes), is colonized by almost monospecific populations of *Salicornia perennans*, an annual species of growing interest in the culinary field [192]. At the immediately higher level we find *Salicornia perennis*, a perennial species that prefers conditions of lower soil humidity [232] and is used by coastal populations all over the world as food [121,142]. It is succeeded by *Limonium narbonense*, a perennial herbaceous, with beautiful late summer blooms, with a rosy–lilac color, almost reminiscent of those of lavender, and particularly long-lasting, known not only for its ornamental characteristics but also for its food and medicinal use [146,172]; it is in fact used and studied for antibacterial, antiviral, cytotoxic, and anti-hemorrhagic activity [172]. Immediately above the *Limonium* area, where the soil becomes even more clayey and more asphyxiated, a monospecific band of *Artemisia caerulescens* can be identified, a perennial plant whose aerial parts contain an essential oil with antibacterial, cytotoxic, and antifungal activity [233] and which is used also to flavor grappa and bitters [110]. The species is particularly demanding towards the substratum, preferring clayey rather than sandy soils, and hardly tolerates the anthropic impact. These characteristics have probably greatly limited its diffusion, so much so that it is rare in other similar contexts, including the more anthropized portion of Galanchio. The last level is characterized by a high coverage of *Juncus acutus*, a perennial rush species, with an edible rhizome, and used as a medicine [103,105], for its multiple diuretic, sedative, and anti-inflammatory properties, but also cytotoxic, anti-acetylcholinesterase, and antioxidants [167].

The area of Galanchio is, on the whole, more disturbed by anthropogenic action, as much of the land is exploited annually for cultivation purposes and therefore subject to periodic tillage [20]. This strongly affects the pedo–morphological structure of the soil and the floristic–vegetational composition, significantly altering the ecological characteristics of a large part of the brackish area. Although agronomic practices on the one hand allow an improvement of the soil structure, with a constant supply of organic substances and the selection of plant species more resistant to repeated mowing, on the other hand they prevent the zoning and, sometimes, also the formation, of phytocoenosis well-framed halophiles. In some stretches less affected by the excessive rise in the levels of salinity in the soil, the halophilic species are thus accompanied by a substantial number of individuals of glycophilic species such as *Rumex acetosella* or species that are not purely halophilic but perhaps have a certain halotolerance and for this reason have been inserted in the eHaloph databases [24]. Among the latter, we point out *Portulaca oleracea*, not present in the Lame, a very widespread synanthropic–ruderal plant. This species prefers soils rich in nitrates, is a weed of summer irrigated crops, and is widely used as food [7] and in popular medicine for coughs, as a vermifuge and diuretic, for blood purification, for toothache and stomach or liver pain [114,186,188].

Among the peculiar halophytes of ethnobotanical interest, *Halimione portulacoides* and *Soda inermis*, are abundant in the less worked areas of Galanchio. These areas are characterized by soil, in which the sandy component prevails over the clayey one, allowing better drainage and at the same time a better ascent of saline waters from the underground aquifer with increasing temperatures.

Halimione portulacoides is a perennial shrub used in human nutrition and folk medicine to control diabetes [119]. Its aerial parts contain antioxidant and bioactive molecules to be used in the medical and pharmaceutical fields [152]. The species can be present either in dense monospecific populations or, as happens in the drains of the area, mixed with *Salicornia perennans*.

Soda inermis, an annual halonitrophilous herbaceous species, is widely cultivated and marketed above all for food use [121] but interest in it as a medicinal plant with diuretic properties in case of kidney stones is not lacking [187]. In the past it was an important source of sodium bicarbonate, which was extracted from its ashes and used in the production of glass; the very name refers to its use as a source of soda [211]. *S. inermis* grows sporadically in areas populated by low vegetation together with other herbaceous species, some of which are included in the ethnobotanical list (Table 2), such as the already mentioned *Trifolium squamosum*, also present only in Galanchio and known in popular medicine [227].

The comparative analysis of the halophytic flora between the two saline areas is even more detailed if we consult the interactive digital thematic maps, in which both the distribution of halophytes and the variations of presence and frequency within the area are shown (Figure 4). Since these species are ecological indicators of soil salinity, through this type of graphic representation it is possible to identify the areas with a higher salt concentration and therefore to outline a precise, immediately viewable picture of the environmental and critical characteristics of the analyzed site as well as the distribution preferences of the single species. These data are very useful for the choice of the most suitable sites in both conservation and genetic improvement programs to be carried out in field conditions.

To complete the study, for a critical evaluation of the ethnobotanical value of the entire analyzed area, it is also appropriate to consider the total number of eu- or myohalophytic species known to be used in at least one of the more traditional sectors considered. Overall, 39 species of proven ethnobotanical interest were identified, divided between 11 euhalophytes and 28 myohalophytes, equal to almost 50% of the total species present. These species belong to 11 families of which the Poaceae and Amaranthaceae are the most represented. Of these species, 24 have an application in the food sector and 33 also or only in the medical one. To these it is possible to add some species whose use has not yet been declared but on which research in the pharmacological field is underway. An example is *Juncus gerardi*, a rhizomatous perennial plant present in both stations and recently investigated for the content of phenanthrenes, compounds with cytotoxic activity [157].

Among the species common to both salt pans, and most indicative of this type of habitat, we can mention *Galatella tripolium*, a rhizomatous biennial plant, with characteristic pinkish blooms, used as a vegetable [147–149] but also as nutraceutical food [144] for the prevention and treatment of diabetes [145]. It has a high nutritional value as it contains minerals, considerable quantities of flavonoids, caffeoyl esters, polyphenols, and hydrocynnamic acids [146], which give it antioxidant and anti-inflammatory properties. The flowering, which takes place in late summer, allows the production of a yellow monofloral honey with a brackish flavor [150].

Suaeda vera and *Suaeda maritima*, both euhalophytes, are two other particularly interesting species both from an environmental and naturalistic point of view, and for their known uses.

Suaeda vera, a perennial shrub species, is used not only as a vegetable but also in folk medicine for the treatment of osteoarticular disorders, as an antidiabetic because it is hypoglycemic, and against liver diseases [222]. Recent studies have highlighted its antibacterial and anticancer properties [115,221]. The essential oil of this species consists of molecules with antioxidant activity [126], which make it a possible nutraceutical food or possible source of these compounds [103]. The leaves can be used as a black dye [234].

Suaeda maritima, annual, is used as a food in different parts of the world [121,218]. It possesses high nutritional levels [126,217], medicinal properties against hepatitis, and is an antiviral [58,220]. It has also been used for its anti-inflammatory, antibacterial, immunostimulant, and antioxidant activities [103,146]. Other sources have reported its use in folk medicine for the treatment of rheumatism, paralysis, asthma, and snake bites and against skin diseases and ulcers [103,220].

5. Conclusions

This study, although further investigation is required regarding the complexity of the species present in the analyzed area, outlined an explanatory picture of the naturalistic and ethnobotanical value of its most characteristic and peculiar floristic contingent. In particular, the high number of halophilic species with ethnobotanical interest surveyed in the two brackish study areas clearly delineate their considerable potential as germplasm banks that can be used as a valuable resource for both food or craft and pharmaceutical and nutraceutical purposes. As a result, these areas have proved to be important providers of multiple ecosystem services. Added to this is the importance of their conservation in the Mediterranean area, where there is a progressive decrease in these types of habitats due to anthropic changes.

The research carried out could also play a key role in the preservation and/or recovery of information in ethnobotany especially for the northwestern countries of the Mediterranean area where, as can be seen from the literature, such knowledge has declined sharply. In particular, it is interesting to note that in these same territories, which have been richer and more technologically advanced for a long time, ethnobotanical knowledge and research on halophytes is far less than in the southern nations that are part of the Mediterranean basin. One explanation for this is the persistence of historical memory and the maintenance of folk uses of these species in economically less affluent areas. The use of identification and georeferencing systems in the field, correlated to the creation of geographic databases, can be an extremely functional and dynamic tool in the census and monitoring of these species.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/agronomy13030615/s1.

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Appendix A

Table A1. List of plant species inventoried at study areas with their life and chorological forms. (L = Lame area; G = Galanchio area; P caesp/scap/lian = caespitose/scapose/lianas phanerophytes; NP = nanophanerophytes; Ch frut/succ = frutescent/succulents chamaephytes; H bienn/scap/caesp/rept = biennial/scapose/caespitose/reptant hemicryptophytes; G rhiz = rhizome geophyte; He = helophytes; I nat/rad = errant/root idrophytes T scap = scapose therophytes).

Species	Life Form	Chorological Type	Area
Amaranthaceae			
Atriplex patula L.	T scap	Circumbor.	L
Atriplex prostrata Boucher ex DC.	T scap	C-Asiat./Eurimedit.	L/G
Atriplex littoralis L.	T scap	Eurasiat.	L/G
Halimione portulacoides Aellen	Ch frut	Circumbor.	G
Salicornia perennans Willd.	T scap	W-Europ.	L/G
Salicornia perennis Mill.	Ch succ	Euri-Medit.	L/G
Soda inermis Fourr.	T scap	Paleotemp.	G
Suaeda vera J.F. Gmel.	NP	Cosmop.	L/G
Suaeda maritima (L.) Dumort.	T scap	Cosmop.	L/G
Apocynaceae			
Periploca graeca L.	P lian	NE-Medit.	L
Asteraceae			
Artemisia caerulescens L.	Ch suffr	Euri-Medit.	L/G
Galatella tripolium (L.) Gal. Bart. and Ard.	H bienn	Eurasiat.	L/G
Limbarda crithmoides (L.) Dumort.	Ch suffr	Medit.-Atl.(Steno-)	L/G
Helminthotheca echioides (L.) Holub	T scap	Euri-Medit./Euri-Medit.-Orient.	L
Xanthium strumarium L.	T scap	Cosmop.	L
Caryophyllaceae			
Spergularia marina (L.) Besser	T scap	Subcosmop.	L/G
Spergularia media (L.) C. Presl	Ch suffr	Subcosmop.	L/G
Cyperaceae			
Bolboschoenus maritimus (L.) Palla	G rhiz	Cosmop.	L/G
Eleocharis palustris (L.) Roem. and Schult.	G rhiz	Subcosmop.	L
Isolepis setacea (L.) R. Br.	T scap	Paleotemp./Subtrop.	L
Schoenoplectus pungens (Vahl) Palla	G rhiz/He	Subcosmop.	L
Carex distans L.	H caesp	Eurimedit.	L
Carex divisa Huds.	G rhiz	Atl./Euri-Medit.	L/G
Carex elata All	H caesp	Europ.-Caucas.	L
Carex otrubae Podp.	H caesp	Atl./Euri-Medit.	L
Cladium mariscus (L.) Pohl	G rhiz	Subcosmop.	L
Cyperus longus L.	G rhiz/He	Paleotemp.	L
Schoenoplectus lacustris (L.) Palla	G rhiz/He	Subcosmop.	L

Table A1. *Cont.*

Species	Life Form	Chorological Type	Area
Schoenus nigricans L.	H caesp	Subcosmop.	L
Scirpoides holoschoenus (L.)	G rhiz	Euri-Medit./Macarones.	L/G
Euphorbiaceae			
Euphorbia hirsute L.	G rhiz	Medit./Macarones	L
Euphorbia platiphyllos L.	T scap	Cosmop./Subcosmop.	L
Fabaceae			
Lotus corniculatus L.	H scap	Cosmop./Paleotemp./Subcosmop.	L
Lotus tenuis Waldst. et Kit. ex Willd.	H scap	Paleotemp.	L/G
Trifolium squamosum L.	T scap	Euri-Medit.	G
Trifolium resupinatum L.	H rept/T rept	Paleotemp.	L
Gentianaceae			
Blackstonia acuminata (Koch and Ziz) Domin	T scap	Medit.	L/G
Centaurium erythreae Rafn	H bienn/H scap	Paleotemp.	L
Juncaceae			
Juncus acutus L.	H caesp	Euri-Medit.	L/G
Juncus maritimus Lam.	G rhiz	Subcosmop.	L/G
Juncus gerardii Loisel.	G rhiz	Circumbor.	L/G
Juncus articulatus L.	G rhiz	Circumbor.	L/G
Juncus conglomeratus L.	G rhiz/H caesp	Eurosiber.	L
Juncus effusus L.	G rhiz/H caesp	Cosmop.	L
Lauraceae			
Laurus nobilis L.	P caesp/P scap	Steno-Medit.	L
Linaceae			
Linum trigynum L.	T scap	Euri-Medit.	L/G
Lythraceae			
Lythrum tribracteatum Salzm. ex Spreng.	T scap	Euri-Medit.	L
Malvaceae			
Althaea officinalis L.	H scap	SE-Europ./Sudsiber.	L
Plantaginaceae			
Plantago coronopus L.	H ros/T scap	Euri-Medit.	L/G
Plumbaginaceae			
Limonium narbonense Mill.	H ros	Euri-Medit.	L/G
Poaceae			
Aeluropus littoralis (Gouan) Parl.	G rhiz	Medit.-Turan./N-Medit.	L/G
Arundo donax L.	G rhiz	Subcosmop.	L/G
Cynodon dactylon (L.) Pers.	G rhiz/H rept	Cosmop.	L/G
Elymus repens (L.) Gould	G rhiz	Circumbor.	L/G
Hordeum marinum Huds.	T scap	Euri-Medit.-Occid./Subatl.	L/G
Imperata cylindrica(L.) P. Beauv.	G rhiz	Cosmop.	L

Table A1. *Cont.*

Species	Life Form	Chorological Type	Area
Parapholis filiformis (Roth) C.E. Hubb.	T scap	Medit.-Atl. (Euri-)	L/G
Parapholis incurva (L.) C.E. Hubb.	T scap	Medit.-Atl. (Euri-)	L
Polypogon monspeliensis (L.) Desf.	T scap	Paleosubtrop.	L/G
Puccinellia festuciformis (Host) Parl.	H caesp	Steno-Medit.	G
Puccinellia distans (Jacq.) Parl.	H caesp	Paleotemp.	L
Sporobolus aculeatus (L.) Pet.	T scap	Paleosubtrop.	L/G
Sporobolus pumilus (Roth) Pet. and Saarela	G rhiz	Anfiatl.	L/G
Sporobolus virginicus (L.) Kunth	G rhiz	Subtrop.	L/G
Thinopyrum acutum (DC.) Banfi	H caesp	Medit.	G
Lolium perenne L.	H caesp	Circumbor./Eurasiat.	L
Lolium multiflorum Lam.	H scap/T scap	Euri-Medit.	L/G
Polygonaceae			
Rumex acetosella L.	H sca	Eurosiber./Subcosmop.	G
Portulacaceae			
Portulaca oleracea L.	T scap	Subcosmop.	G
Primulaceae			
Lysimachia arvensis (L.) U. Manns and Anderb.	T rept	Cosmop./Euri-Medit./Subcosmop.	L
Ranunculaceae			
Ranunculus sardous Crantz	T scap	Euri-Medit.	L/G
Rosaceae			
Crataegus monogyna Jacq.	P caesp/P scap	Eurasiat./Paleotemp.	L
Prunus spinosa L.	P caesp	Euroasiat./Europ-Caucas.	L
Rubiaceae			
Galium debile Desv.	H scap	Euri-Medit.	L
Ruppiaceae			
Ruppia maritima L.	I nat/I rad	Cosmop.	L
Tamaricaceae			
Tamarix gallica L.	P scap/Pcaesp	W-Medit.	L/G
Ulmaceae			
Ulmus minor Mill.	P caesp/P scap	Europ.-Caucas.	L
Verbenaceae			
Phyla nodiflora (L.) Greene	H rept	Pantrop./Subtrop.	L

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