AUTOCHTHON AND ALLOCHTHON FLORA FROM THE ALTA MURGIA NATIONAL PARK

Introduction to the main species

Edited by
Francesca Casella
Maria Chiara Zonno

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National Council of Research
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This informative has been designed to explain the main plant species in different habitats of the Alta Murgia National Park, highlighting the difference between native and non-native ones. Among the non-native species we report the main invasive ones that pose a threat to the Park's biodiversity and the main naturalized non-invasive species.
The main objective is to inform and sensitize a wide public on the issues of invasive alien species and biodiversity conservation.

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The flora of the Alta Murgia is characterized by a particular richness of species and plant communities. This has resulted from soil and climate conditions and the strong influence of man's activities which, in the past, have modelled the landscape and vegetation. The Alta Murgia extends over an undulating karst plateau where the most fertile areas are at the bottom of numerous erosive furrows (commonly called "lame") that run through the area. In the past, those were the only cultivated areas while the rest consisted of thermo-mesophilic woods and natural pastures on rocky lands. That is why North-western Murgia has been the best location for grazing sheep and goats for long time. The presence of numerous flocks has strongly influenced the characteristics of the native flora, especially in the pastures, giving rise to ecologically considerable plant associations at Community level, associated with a specific fauna. By the April 3, 2000, Decree of the Environment Ministry, the Alta Murgia was designated as among the Sites of Community Importance (SCI, under Directive 92/43/EEC) and Special Protection Areas (SPA, under Directive 79/409/EEC) in the Mediterranean bio-geographical region.

The SCI/SPA "Alta Murgia" (cod. IT9120007 in the Natura 2000 network) has an area of 125,880 hectares, inclusive of the territory of the Alta Murgia National Park, established by Presidential Decree 10/03/2004, occupying an area of about 68,000 hectares. Priority habitats present at Community level on the Alta Murgia are the grasslands on calcareous substrates (*Festuco-Brometalia*) with their impressive orchids and the steppe with grasses and annuals (*Thero-Brachypodietea*). There are also *Quercus trojana* oak woods and limestone slopes of Mediterranean Greece.

A botanical study of the Alta Murgia territory counted 1,103 wild species, excluding those most strongly linked to the presence of man, cultivated and ruderal. If to this former number are added the species excluded and those newly discovered, the number of species present approaches 1,500. This amount represents 25% of the 6,000 species present throughout the country.

Although man has effected many changes in the area over time, changes also related to historical and economic vicissitudes, the Alta Murgia continues to be characterized by a continuum of meadows and pastures

of high environmental value, often interspersed with agricultural and wooded systems.

The forest heritage consists partly of woods of artificial origin in mediocre conservation condition due to poor management and partly of spontaneous formation of high naturalistic value with cenosis under study that reveal a clear ecological-vegetation affinity of our Region with the Balkan peninsula.

The Sites of Community Importance (SCI) and the Special Protection Area (SPA) constitute the "Natura 2000" network conceived for the protection of European biodiversity through the conservation of natural habitats, animal and plant species of Community interest. These areas are not protected in the traditional sense, and do not fall within the framework of law n. 394/91 on protected areas.

The SCI, created under the EC Habitat Directive 92/43 (implemented by D.P.R n. 357/97 and later n. 120/03) are designed to protect biodiversity through specific management plans.

The SPA are provided for, and regulated by the EC Wild Birds Directive 79/409 (implemented in Italy by the Hunting Act n. 157/92). The purpose of the Directive is "wild birds' conservation", which is achieved not only through population protection, but also by protecting natural habitats through the designation of Special Protection Areas.

Habitats in the SCI/SPA "Murgia Alta"

Pseudo-steppe with grasses and annuals of Thero-Brachypodietea

They are composed of dry grasslands dominated by grasses on various kinds of substrates, often calcareous. Those grasslands consist of annual grasses, such as annual flax fairy (*Stipa capensis*.), paleo (*Trachynia distachya*), typical legumes of natural pastures (*Trifolium sp*. Pl.) or perennial herbaceous formations with a predominance of *Cymbopogon hirtus*, sea squill (*Charybdis pancration*), white and yellow asphodel (*Asphodelus ramosus* subsp. *ramosus* and *Asphodelus lutea)*.

Usually, this habitat is found in low elevation areas of the Park or alongside the sub-Mediterranean dry grasslands at higher elevations.

This habitat is difficult to detect and is generally fragmented throughout the territory. The habitat condition is still quite good.

Dry grasslands dominated by Stipa

Factors threatening the grasslands are:

– abandonment of pastoral systems: the absence of this activity quickly triggers transformation towards prairie with shrubs and woodland, resulting in loss of biological diversity;
– overgrazing: mainly during the reproductive period of plant species typical of the habitat, intensive grazing leads to an impoverishment of the herba-

Prairie with grasses and annuals

Prairie with grasses and annuals

ceous community, habitat loss and reduction of plant cover, exposing the soil to erosion. In this case, the loss of biological diversity is remarkable. The overgrazing also causes excessive nitrogen fertilization of soil that facilitates the entry and spread of very competitive nitrophilous plant species which limit the development of the indigenous plants;

– fire: negative effects are increased when grazing follows a fire event preventing the renewal of herbaceous species, increasing soil erosion and reducing biological diversity.

Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)

This habitat corresponds to sub-Mediterranean dry grasslands of the *Scorzoneretalia villosae* order (*Scorzonero-Chrysopogonetalia*) which is found in North-Eastern and South-Eastern Italy.

In South-Eastern Italy these communities consist of endemic alliance (*Hippocrepido glaucae - Stipion austroitalicae*) floristically and ecologically well differentiated which include dry grasslands of Festuco-Brometea class with marked Mediterranean characters.

Sub-Mediterranean dry grasslands

Because of this peculiarity and also because in large areas of the Alta Murgia these grasslands are at risk of disappearing or reducing, part of the scientific community considers timely to propose this as a priority habitat.

Habitat conservation is degraded in some areas, closely influenced by overgrazing and by stones removing, practices almost totally destroying the habitat.

As with the previous habitat, critical factors are represented by:

– abandonment of pastoral systems;
– overgrazing;
– fire.

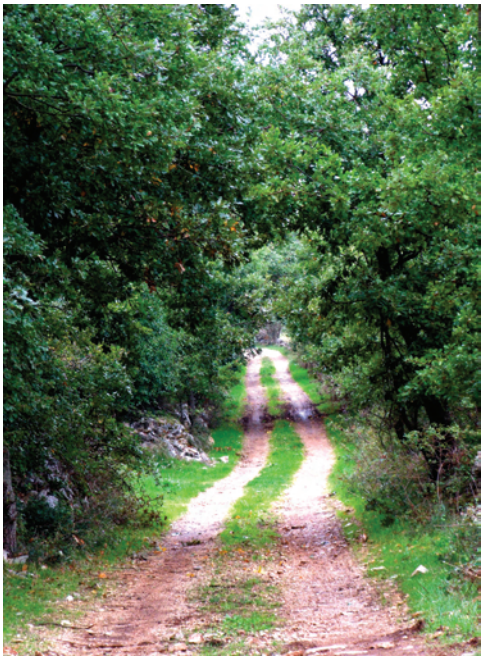
Sub-Mediterranean dry grasslands - summer landscape

Eastern white oak woods (Quercus pubescent)

The habitat includes the Adriatic and Tyrrhenian Mediterranean and Sub-Mediterranean woodland habitat dominated by *Quercus virgiliana*, *Q. dalechampii*, *Q. pubescens* and *Fraxinus ornus*. They are found especially along slopes separating the Upper and Lower Murgia.

Habitat conservation status is mediocre because of coppice population management and the current lack of management consequent to: abandonment, wood price fall and fire.

The most critical factors are:
- abandonment;
- inadequate silviculture;
- fire.



White oak woods

Quercus trojana woods (Macedonian oak)

The habitat consists of pure or mixed *Quercus virgiliana*, *Quercus trojana* and sometimes *Carpinus orientalis* forests, adapted to cooler conditions.

Q. trojana is dominant in residual woodlands of Murgia in the countryside of Matera and Laterza and in the South-Eastern Murge. In the Alta Murgia Park isolated groups of *Q. trojana* occupies limited areas of Altamura and Toritto countryside, while the species is dominant in the mesophilic wood of Santeramo in Colle countryside.

The conservation status of the habitat is medium because of poor management.

In this habitat the most critical factors are:
- inadequate silviculture;
- fire.

Calcareous rocky slopes with chasmophytic vegetation

The rocky vegetation is focused on a combination of *Aurinio megalocarpae - Centaureetum apulae* and *Ibero-carnosae Athamantetum siculi*.

In some of the murgian highland areas, small rocky outcrops are present in vertical progression, with some rare species such as *Campanula versicolor*, *Carum multiflorum* and *Aurinia saxatilis* subsp. *megalocarpa*.

The conservation status of the habitat is good with the presence of many species of characteristic plants.

Eventual critical issues could arise as a result of anthropogenic attendance through:

– trampling;
– collecting of flower stalks;
– fire.

Limestone slopes

Mediterranean temporary ponds

Temporary ponds are natural depressions in which there is almost always one clay layer that allows rainwater to stagnate. The habitat is present in the Park at least in three sites, all linked to communities where *Verbena supine* is dominant.

This habitat has a great biological diversity although it has a delicate balance with a very strong variability based on geological, geomorphological and hydrological dynamics.

Alta Murgia temporary ponds are in good conserva-

Mediterranean temporary ponds

Mediterranean temporary ponds

tion condition; however, the lack of proper management practices could threaten their presence.

Major threats include:

– abandonment of pastoral systems;
– soil tillage.

Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation

This habitat is generally present in lakes, ponds and canals with murky water. The vegetation consists of a few aquatic species, visible on the water surface or just below it. Only their flowers are seen on the surface. They can take root on the bottom or be free-floating.

Natural eutrophic lake

In the Park this habitat is found in one single site over a few square meters area with only one plant species, evidence of poor conservation practices.

Since the habitat is present only in an artificial structure, its transformation, disappearance or mismanagement appear likely.

Definition and importance

The definition of biodiversity was first introduced in 1992 during the United Nations Rio de Janeiro Environmental Conference.

Biological diversity means: "The variability of living organisms, earth and water ecosystems and the ecological complexes they form; biodiversity includes intraspecific, interspecific and ecosystems' diversity ".

Biodiversity is thus evaluated on several levels of biological organization, from genetic to plant and animal communities that compose terrestrial and aquatic environments, considering all the "functional aspects", including the ecological and evolutionary processes that sustain it. Therefore, biodiversity can be:

- genetic: within a species; populations and organisms included in a community are different because they have a unique genetic heritage changing from generation to generation because of recombination and mutations (e.g., breeds and varieties),
- specific: relating to the number of species; species are different from each other, each with its own function in the ecosystem (e.g., different species of orchids or oaks),
- ecosystemic: regarding the diversity of environments; the growth environments of the biotic communities are different from each other because of different climatic and biotic conditions (e.g., woodlands, waterlands, meadows),
- landscape-related: complex interdependent functions are established among different levels.

Such a wealth of diversity is the result of slow evolutionary processes that, under the pressure of natural selection, affect genetic and morphological characteristics of species, thus allowing organisms to adapt to environmental changes.

Species are the living components of the ecosystems, with precise ecological balance among them. Sometimes a species can disappear without changes with the entire life network still maintaining its functionality, thanks

to other similar species filling the ecological niche. If one key species disappears, instead, the entire system becomes unstable: the vital space for other organisms also modifies and vital functions may be lost. Those interactions manifest with great variation within ecosystems and are difficult to predict. Careful observation of diversity among species may, however, provides valuable information about the status of the different ecological complexes.

Flora biodiversity in the Park

Species do not disappear overnight. Their decline is most often the result of a slow process. Before extinction, some species may remain for decades in the list of threatened species. Their populations are generally small and isolated: in the absence of genetic exchange with other interconnected populations, their close kinship can adversely affect their reproductive capacity.

The ability of ecosystems to react to extreme conditions, such as drought or disease, can be limited by the lack of genetic variety. Within a single species there are always individuals better able to tolerate extreme events: the larger and more diversified is the population, the greater is the possibility that these individuals mitigate the overall impact.

The levels that comprise biological diversity are closely related to each other. Species need appropriate and enough habitats and genetic variability to survive. Ecosystems need a variety of species to work. Furthermore, a good relationship among vital environments is indispensable to maintain the variety of species and ecosystems.

Ensuring high biodiversity is a problem affecting quality of life and survival for mankind. Biodiversity gives direct benefit to society, constantly exploited by agriculture, fishing, hunting and timber harvesting. The functional alteration of ecosystems has consequently an economic impact. Changes in biological diversity can directly reduce resources: food, water, fuel, building materials, even genetic and medicinal resources. Plants, for example, are of great value in the field of healthcare as a source of an infinite number of molecules widely used in pharmacology.

In everyday life biodiversity is important for mankind thanks to the numerous benefits provided by ecosystems, which can be divided into the following categories:

– Economic benefit. Ecosystems and their species produce many resources to society such as food, drinking water, energy sources, textiles, building materials and active ingredients for medicines. Genetic resources are the basis for the development of new useful plant species, medicines and raw materials for industry. Ecosystems and their species are important in agriculture for pollination, pest control and soils fertilization.
– Maintenance of climatic and hydrogeological balances. Natural biotic communities in the ecosystems absorb CO_2, protect from avalanches and hydrologic floods, prevent soil erosion and regulate climate. Resilience (from the Latin *Resiliens -entis*, "bouncing") is the community (or ecological system) ability to recover after a disturbance of anthropic (e.g. pollution, deforestation, climate change, alien species invasion) or natural (e.g. weather event, fire, landslide) origin. The more complex and balanced an ecosystem, the better it adapts to changes. Natural Mediterranean ecosystems (e.g., Mediterranean scrub), characterized by a high variability and many environmental factors, developed a strong resilience to natural events such as fires, coastal storms, rocky

slopes collapse. Typical species from those environments are able to quickly re-colonize the destroyed or heavily degraded areas.
– Cultural benefit. The development of society, culture and traditions is closely linked to biodiversity - for instance, to the many species of plants for food, dyeing, herbals, medicinal herbs, etc. Ecosystems and species also contribute to the variety found in landscapes, thus responding to aesthetic and recreational needs of the public.
– Maintenance of basic ecosystem functions. Among the basic essential indirect ecosystem services there are oxygen production and nutrient/water cycles maintenance, leading to direct benefits for many economy and industry sectors: agriculture, forestry, fishing, hunting, sports, tourism, pharmaceuticals, perfumes, textiles, construction, raw materials and healthcare.

Threats to biodiversity

The main cause of the alarming loss of biological diversity on Earth is the human influence on ecosystems at a global level. Man has directly or indirectly altered the environment by transforming the land, globally modifying biogeochemical cycles, exploiting many species through hunting and fishing, polluting, cementing, exploiting natural resources and increasing the possibility of transference of living organisms from one area to another of the planet.

The threats to biodiversity are:

- ***Natural habitats alteration, loss and fragmentation***. Man produces profound changes in land because of demographic explosion, industrial development, extension of transportation networks and agricultural industrialization. In the last century the main changes in land use involved the increase of agriculture and livestock farming activities, the development of urban and commercial areas, massive deforestation, the expansion of road networks and related infrastructures, the construction of hydroelectric systems, the creation of water main networks and water works, river beds cementing, the exploitation of subsoil deposits, construction of recreational and sport infrastructures. The loss, fragmentation or conversion of natural areas lead to the reduction in plant and animal species associated with those areas.

- ***Introduction of alien species***. They are species native to other geographical areas and not adapted through natural selection to the new environment. It is important to consider that species evolved over millions years, and also they co-evolved that's to say they adapted to each other thus co-existing in certain areas characterized by specific conditions (physical, chemical, climatic, vegetative). Currently, the increasing invasions of alien species is one of the main environmental emergency. The international scientific community consider that the second leading cause of the global biodiversity loss. It has been estimated that almost 20% of extinctions of birds and mammals can be attributed to direct actions by introduced animals (especially mammals). This may have several causes: competition for limited resources, predation by the introduced species and spread of new diseases and parasites. We must also consider the damages that many introduced species can cause to natural vegetation, crops and livestock.
- ***Pollution***. Human activities such as industry and agriculture affect natural environment by direct or indirect negative effects that alter energy flows, environment chemical-physical composition and species abundance.
- ***Climate changes***. The heating of the ground affects biodiversity because it endangers all species adapted to cold, both for latitude (polar species) and elevation (mountain species) reason.
- ***Over-exploitation of natural resources***. When capture and harvest activities (hunting, fishing, crops) of a renewable natural resource in a certain area is excessively intense, the resource is at depletion risk. That's what is happening, with many species that man captures without giving them time or opportunity to reproduce

Biodiversity conservation

The crisis caused by the biodiversity loss gave rise in the 50s to a new branch of science, conservation biology, being now one of the most growing fields of modern scientific research. This applied discipline integrates principles of natural and social sciences with the goal of maintaining long-term biodiversity on Earth. Both history and science showed that the uncontrolled and unplanned exploitation of resources causes alteration of ecosystems. Therefore, a responsible and rational planning to manage our

environmental heritage is important to ensure life conservation on our planet. The management must address the problems related to the conservation of endangered species through appropriate measures, such as: the creation of protected areas and natural parks, the planning of species reintroduction or eradication, the regulation of hunting human presence and animal commerce in the area.

Alta Murgia: problems and threats

The Alta Murgia area is characterized by a karst system with high resilience that was able to adapt to natural and human changes throughout the centuries. However, some threats still exist, due to the minimal consideration for areas, which have poor agricultural and economic potential, but high natural value. For this reason such areas are used as site for energy production systems or landfills.

The ecological and landscape net, is the result of geological and climatic conditions, as well as of human activities throughout centuries. We can see both recent and remote transformations, that have slowly and steadily shaped this territory over long time. The main landscape and ecosystem modification factor was the perpetuation of agro-forestry-pastoral activity over centuries. In some cases, the modifications were so heavy to create new ecosystems, which evolved until reaching a balanced state. Most of the pseudo-steppe areas derive from the transformation of woods and shrublands into pastures or croplands for herbaceous species.

The Park was exposed to a tremendously accelerated process of habitat loss and fragmentation by a number of combined pressures. Among these, the Common Agricultural Policy drove transformation of natural grassland pastures into cereal crop areas through stones cleaning. Agricultural abandonment, change in the use of land, intensification of farming, urbanisation and abandonment of or irrational grazing result in lower numbers of plant, invertebrate and consequently bird species.

Grazing and errant livestock decline still constitute a key factor in the degradation and variation in the flora of the Alta Murgia habitats. In fact, the low level of grazing is causing the increase of shrubby plants on the pastureland, while some abandoned croplands next to woods are now colonized by native or alien arboreal plants spread by wind and animals.

Another risk for biodiversity is forest fire, threatening resinous plant/conifers woods. Those were planted in the ‘40s to tackle hydrogeological instability. Artificial populations have been target of poor forestry manage-

ment after planting. For this reason, they are characterized by high density, low specific biodiversity, coetaneous cenosis and low undergrowth. Nevertheless, they represent the habitat for valuable species such as wolves, porcupines, badgers, turtles, hedgehogs, etc. Therefore, they need effective management to increase the number of indigenous plant species, the complexity of the population and the difference in age among individuals, and to reduce flammable biomass thus reducing the risk of fire.

In the Park there are different types of environment very often interlard with each other like in a mosaic. Apart from crops or synanthropic vegetation and limited environments (e.g. rocky slopes and temporary ponds), the major environmental types of flora in the Park are:

– dry grasslands,
– shrublands,
– mixed oak woodlands,
– conifer reforestations.

Dry grasslands

The most characteristic environment of the Alta Murgia National Park is the pseudo-steppe, expanses of herbaceous vegetation very similar to the well-known Eurasian steppes. Those Murgian prairies are extremely

Habitat destruction caused by stone clearance

Stipa austroitalica

heterogeneous. In many cases they represent the last stages of degradation of woodlands and shrubs or a type of vegetation rapidly colonizing abandoned crop areas. It is not fully understood whether grasslands have entirely secondary origin or they represent the natural vegetation of the higher areas of the plateau and steeper slopes.

Although a floristic-vegetation classification of grasslands is difficult to make, we can state they are characterized by numerous species of grasses including fairy flax (*Stipa austroitalica* subsp. *austroitalica*).

Stipa flowers in May and June creating an extremely appealing landscape with its unique golden blooms swaying in the wind. Stipa is included in Annex II of Habitat Directive 92/43/EC and is thereby protected by European law; this is typical of dry, stony grasslands on very shallow, steep soils, abundant along the western side of the plateau at elevations above 400 m. Since its distribution is limited to southern Italy, Stipa can be considered an indigenous species.

Other perennial grasses belonging to the Mediterranean pseudo-steppe vegetation are fescue (*Festuca circummediterranea*), southern paleo (*Koeleria splendens*) and erect brome (*Bromus erectus*). They have a

common growth mode: they all are perennial species which appear as dense clumps of leaves on the soil and winter as dormant buds at ground level. *Scorzonera villosa* subsp. *columnae*, Asteracea with yellow flowers, is also very common. It is almost invisible in winter due to an underground stem (rhizome), which produces new sprouts every year. It is found on both sides of the Adriatic Sea, and in Italy is limited to the South.

Scorzonera villosa

Scented Labiatae also hold an important place in the Murgian dry grasslands. Native thyme (*Thymus spinulosus*) and *Acinos suaveolens* are often found. *T. spinulosus* is a creeping plant with a woody stem which forms dense, fragrant carpets among rocks; the plant has linear leaves and blooms in May and June with very fragrant, small, white-pink flowers. The species is native to and present only in central and South-central Italy while *A. suaveolens* is found throughout South-Eastern Europe. It forms woody short seedlings growing among the rocks and elliptical leaves with an intense and pungent smell; the violet flowers appear in May-June. Among the low grasses there is spiny spurge (*Euphorbia spinosa*), with its typical pillow shape, a common adaptation of some Murgian plants, allowing them to adhere to the ground thus defending themselves from the cold winter winds, as well as limiting water loss through evapotranspiration in warm periods.

A part of grasslands is occupied by some thorny plants such as the field Eryngo (*Eryngium campestre*) and amethyst Eryngo (*Eryngium amethystinum*), along with the saprophyte fungus *Pleurotus eringi*, typical from Murgia. The density of thorny plants depends on the grazing level, influencing the appearance of other thorny species locally called "thistles", such as: *Carduus micropterus* subsp *perspinosus*, a native subspecies from South-central Italy), the

Carduus micropterus

small Italian *Carduus pycnocephalus* and *Onopordum illyricum*, blooming in June and July in heavily grazed areas.

Grazing fosters the increase of herbaceous species which are unappealing to livestock because of their toxicity or bitterness, such as sea squill (*Urginea maritima*), Mediterranean asphodel (*Asphodelus ramosus*), yellow asphodel (*Asphodeline lutea*) and giant fennel (*Ferula communis*) Sea squill is bulbous, equipped with an underground bulb

Asphodelus ramosus

which can reach a diameter of 20 cm and weigh of several kilograms; in autumn-winter a clump of glossy, dark-green, lanceolate leaves sprout from the bulb, while in late summer one flowering stem emerges, up to 1.5 m, waving in the wind with its many white-pink blossoms. Asphodels are among the most common species in overgrazed areas; they are easily recognized as soon as they flower: *A. ramosus* has abundant pale pink flowers, while *A. lutea* has yellow ones. The yellow asphodel is also distinguishable by its linear green, glaucous leaves, while pink asphodel has lanceolate ones with a triangular section. Lastly, ferula is a characteristic species in Murgia and Apulia landscapes, even after flowering, when the woody branched stem dries, remaining highly visible in the fields for several months. Ferula leaves are compound and divided in linear segments; they are gathered in clumps and ignored by grazing animals because of their toxicity.

Ferula communis

Ferula inflorescences can reach the height of one meter and a half and becomes woody when dried; in the past, stems were used to make stools for shepherds.

According to site, elevation, anthropic disturbance, fire frequency, Murgia grasslands are enriched by annual species such as the ovate goatgrass (*Aegilops geniculate*), *Sideritis romana*, clovers (*Trifolium* spp.) and needle grass (*Stipa capensis*), or such bulbous plants as grape hyacinths (*Muscari* spp.), the purple grape hyacinth (*Leopoldia comosa*) and the Star-of-Bethlehem (*Ornithogalum* spp.).

Alta Murgia pseudo-steppes are characterized by numerous species of orchids, especially those of the genera *Ophrys, Anacamptis* and *Neotinea*.

The Orchidaceae family encompasses a large number of species and is

Aegilops genicolata

Ophrys murgiana

protected by international conventions; speciation of Mediterranean orchids is still progressing and the number of described species is increasing. For these reasons, the presence of copious orchids flowerings makes Murgian fields a "priority" for conservation under the "Habitats Directive".

Among the most common and earlier flowering orchids there is Robert's orchids (*Himantoglossum robertianum*), appearing in meadows, olive tree groves and croplands edges at the end of January. Soon later, in early spring, the small red-fuchsia precious *Anacamptis collina* blooms in abandoned cultivated fields. Beginning in mid-March, numerous orchids bloom one after another. The most peculiar genus is *Ophrys*, whose flower faithfully repro-

duces the appearance of its pollinator insect, even imitating the specific smell by producing the specific pheromone. Among the *Ophrys* orchids present in the Park, the Murgian early orchid (*Ophrys murgiana*) is the most important, considered native exclusively of Alta Murgia. It blooms in rather localized areas from mid-March to mid-April. Among the rare localized orchids, Matera orchid *(Ophrys exaltata* subsp. *meteolana)* is a unique subspecies present only in a few areas between Alta Murgia and Murgia Materana. *Ophrys holosericea* subsp. *parvimaculata* and *Ophrys peucetiae*, the latest to be discovered, flower lately; both prefer more or less open woodlands populated by young oak trees. Those two species, similar to the better known *Ophys holosericea*, are still under taxonomic study and are native to Apulia. Widespread in most of Mediterranean pastures there are: *Ophrys tenthredinifera*, "lutea" *Ophrys* (*O. lutea*, *O. lutea* subsp. *minor*, *O. fusca*, etc.), *O. incubator, O. bertolonii* and *O. passionis*.

Murgian orchids belonging to the *Orchis*, *Neotinea* and *Anacamptis* genera gradually become more frequent in dry grasslands as the elevation increases; the green-winged orchid (*Anacamptis morio*), the butterfly orchid (*Anacamptis papilionacea*) and the Italian or-

Ophrys meteolana

Anacamptis morio

chid (*Orchis italica*) are numerous and almost omnipresent; in April-May the unusual Serapidi orchids appear with their red blooms with leafy aspect.

Fields of shrubs

They are transition environments often found at the edge of oak woods and creating a strip connecting woods with grasslands. The shrublands are made up of different native species such as wild pear (*Pyrus spinosa*), Webb almond (*Prunus webbii*), blackthorn (*Prunus spinosa*), hawthorn (*Crataegus monogyna*), wild rose (*Rosa canina*) and several early-stage oak species.

The wild pear is undoubtedly the most common species in the Alta Murgia, ranging from small to very tall trees up to 5-6 meters in height; it blooms profusely in April and May with large clusters of white flowers, followed by small spherical pear fruits which mature in summer and remain on the plant until late winter. The fruit is edible but sour and woody; in the past they were used to feed pigs.

Pyrus spinosa

Crataegus monogyna

Webb almond tree is found especially on the Adriatic coast. The species has a predominantly Eastern distribution and in Italy it is confined only in some Apulia and Sicily environments. It forms deciduous, highly branched, thorny, small tree or bush that at first glance could be confused with a wild almond. It opens the Murgian blooming season in late winter, blossoming before producing its leaves. Flowers are pure white with a bright pink spot at the base of the petals. The

Rosa canina

fruits ripen in July and are very similar to almond drupes but smaller, with pointed extremities and a very bitter flavour. This sturdy little tree is considered the wild ancestor of the domestic almond.

Blackthorn is a deciduous, highly branched, spiny shrub, which rarely becomes a tree. Its wood is dark and its hairless dark green leaves are lanceolate with serrate edges. It has a wide geographical distribution embracing Europe and Asia. It blooms in February and March, with snow-white flowers that precede the emergence of leaves. Its small, blue-black, round fruits ripen in early summer, are edible and rich in vitamin C, but acidulous and tannic. The plant reproduces vegetatively, often forming small tangles of brush, which provide an excellent shelter for birds and small animals.

Hawthorn is a small deciduous, often bushy tree up to 4-5 m tall. Leaves have deep triangular lobes and notched apex. It is a widely distributed species (Eurasian); it blooms in late spring or early summer, producing many small white bunches of flowers (corymbs) that ripen into dense bunches of 1 cm diameter red drupes. Fruits remain on the plant all winter long, and as such are a good food reserve for birds.

Asparagus (*Asparagus acutifolius*) is among the herbaceous species that characterize the shrublands and woods undergrowth. Common in the Mediterranean Region, asparagus blooms in late summer with tiny, hardly visible flowers and produces black berries. The edible part consists of new buds called "turions".

On the most rocky highland areas, next to the Western slope, wild olive (*Olea europaea var. sylvestris*) and rock buckthorn (*Rhamnus saxatilis* subsp. *infectorius*) are frequent, while on the slope towards the Adriatic sea there are common shrubs such as terebinth (*Pistacia terebinthus*) and Italian buckthorn (*Rhamnus alaternus*).

Shrublands are rapidly evolving environments: they tend to close off and to become forests if not disturbed by factors such as grazing and fire; conversely, when severely disturbed, they can regress into arid grasslands.

Mixed-oak woods

They are located mainly along the Adriatic side of the Alta Murgia plateau between 300 and 500 m a.s.l. The Scoparello Woods in the countryside of Ruvo di Apulia is the most important, in addition to the woods located in Santeramo in Colle, Cassano Murge and Toritto. They are remains of oak copses survived to man's massive transformations of the Murgian plateau over the centuries, such as deforestation, fire and intensive

grazing. Poor management and abandonment resulted in their general degraded status and limited size. For centuries oak woods were a source of wealth for the population: indeed there are many areas where people grazed animals and gathered firewood or acorns to feed animals; other woods, instead, were hunting grounds for the exclusive use of rich local landowners.

The downy oak (*Quercus pubescens s.l.*) is the most widespread tree species in these environments. Downy oak is a term used by some botanists to generally encompass a group of species difficult to distinguish and having common ecological characteristics such as resistance to drought, adaptability and resprout capacity after cutting and fire. Downy oak is common in Southern and Eastern Europe till the Black Sea. It can be extremely long-lived and can reach considerable size. Century-old oaks are located mainly

Quercus pubescens

near manor farms and sheepfolds where they were spared from cutting to shade or to mark property boundaries. Within copse woods larger oaks were saved as seeds source to ensure the renewal of the forest after cutting.

Along with the downy oak, the turkey oak (*Quercus cerris)* populates the western part of the Park. It grows throughout the Mediterranean countries from Spain to Greece. It prefers fresh deep soil on hills and low mountains, especially in southern Italy. It can reach the height of 40 m and is not particularly longlived if compared with other oaks; its wood was customarily used for railroad ties, barrel slats and wheel spokes.

Among the most significant oak species for conservation in our area there is the Macedonian oak (*Quercus trojana)*. The species is semi-decid-

Quercus trojana

Quercus ilex

uous: its leaves desiccate in autumn remaining attached to the branches until the following spring when they are replaced by new leaves. This is an adaptation to the Mediterranean seasonal events, since the leaves remaining on the branches protect the newly emerging buds from spring frosts. *Q. trojana* has Balkan distribution: it is very common on the other side of the Adriatic sea, while in Italy it is present between Southeastern Murgia, Salento and the Matera. Within the park there are small remains or isolated trees of *Q. trojana*, representing the most western distribution.

In the lower areas sloping towards the Adriatic sea, along with deciduous oaks there are evergreen oak species, such as the holm oak (*Quercus ilex*) and the Palestine oak (*Quercus calliprinos*). Holm oak is a tree with Mediterranean distribution, difficult to find in the hinterland, and preferringMediterranean scrub or rocky soils where it grows as a bush. Also Kermes oak (*Quercus coccifera*) is found occasionally as solitary shrub in degraded, thermo-xerophilic, broad-leaved woods. It has small, elliptical spiny leaves.

Other oaks such as the broad-leaved Italian oak (*Quercus frainetto*), the deciduous flowering ash (*Fraxinus ornus*), the Montpellier maple (*Acer monspessulanum*) and terebinth (*Pistacia therebintus*) are less common. In the undergrowth typical shrubbery of Mediterranean scrub predominate such as mastic trees (*Pistacia lentiscus*), *Phillyrea* spp., common hawthorn (*Crataegus monogyna*), honeysuckle (*Lonicera* spp.), and there are locally valuable species such as the native Apulian arum (*Arum apulum*) and the rare male peony (*Paeonia mascula*).

The Apulian arum is an endemic species of central Apulia confined to shady and fertile soils, whereas the Italian arum (*Arum italicum*) is more

Paeonia mascula

common and adaptable. *A. apulum* has a very distinctive inflorescence which attracts pollinating insects into a cone by alluring substances, holding them until they have either collected pollen or deposited it on the stigma. This species grows in the fall, blooms in April and bears fruits in July.

The male peony is a valuable species that prefers the environment of deciduous oak woods. It is present throughout Europe, but in Apulia it is extremely localized in the mesophilic woods. The beauty of its large, fuchsia flowers gives it an additional value. It blooms in April and subsequently produces its characteristic, star-shaped fruit.

Conifers reforestations

Conifers reforestations occupy wide areas of the Park and are very important for their ecological and landscape roles. Those forests were artificially planted between the thirties and the nineties. The most planted tree species were the Aleppo pine (*Pinus halepensis*) and cypress (*Cupressus sempervirens* and *Cupressus arizonica*), alien to the Murgian ecosystem

and chosen for their ability to adapt to rocky soils and to extreme conditions. They can now be defined as naturalized.

The Aleppo pine has Mediterranean distribution from Spain to Syria and from North Africa up to Yugoslavia. It is found mainly in coastal environments. It is a pioneer species with great ability of regrowth after occasional fire damage thanks to its pine cones which open after the damage, liberating its seeds (pine nuts) that then re-colonise the burned area. The common cypress, native to eastern Mediterranean, was introduced into Italy and Europe in ancient times, probably by the Phoenicians, and then it spread widely driven by man over the centuries, thanks to its adaptability and ornamental value.

The Arizona cypress (*Cupressus arizonica*) is native to America and introduced into Europe during the last century for ornamental purpose. Its adaptability to poor soils has fostered its use in reforestation.

In reforestation areas other species of conifers such as the stone pine (*Pinus pinea*), the Atlas cedar (*Cedrus atlantica*), the Douglas fir (*Pseudotsuga menziesii*) and various species of broadleaf trees such as eucalyptus (*Eucalyptus spp.*) and black locust (*Robinia pseudoacacia*) are also occasionally found.

Reforestation of conifers

Alien species (or non-native, exotic, allochthonous, not-indigenous) are animals or plants that are introduced accidentally or deliberately into a natural environment where they are not normally found.

A result of human intervention is the disappearance of natural barriers (oceans, mountains, rivers, etc.) that in the past localized the development of flora and fauna within certain regions. Various species came and are still arriving at locations thousands of kilometres away from their original habitats. In many cases, allochthonous species adapt poorly to their new environment and they rapidly die out, while in other cases they do survive, reproduce and become established permanently. In some instances, those new aliens develop so well that they become a significant threat to the local ecosystems as well as to agriculture and livestock farming activities, both affecting human health and producing serious economic consequences.

We can distinguish among different types of alien species:

Accidental. Alien species that occasionally flower or reproduce in an area, but do not form self-sustaining populations thus requiring repeated introductions to persist.

Naturalized. Alien species that reproduce consistently and generate populations for many life cycles, self-sustaining without human intervention. Such species well adapt to the new environment and usually produce a good number of seedlings not far from the adult plants and not necessarily invading natural, semi-natural or artificial ecosystems.

Invasive. Naturalized species that reproduce abundantly and quickly by generating plantlets in large numbers at a considerable distance from the mother plants, colonizing new areas and becoming damaging.

While accidental and naturalized alien plants do not create major problems for habitats hosting them, the danger of invasive species lies in their ability to settle permanently within natural and semi-natural habitats, changing their biotic and abiotic characteristics, altering ecosystems and replacing the native flora, thus reducing biodiversity.

Distinction is made within allochthonous plant species based on their period of introduction:

Archeophytes: introduced before 1492, i.e. before European colonialism following America discovery.

Neophytes: introduced after 1492.

In Italy 1023 entities were identified, mainly neophytes (920) mostly considered accidental (437). Among the entities capable of forming stable populations 162 invasive species were recognized, characterized by a high spread rate far from their sites of introduction.

Although exotic species are concentrated mostly in areas with human presence, such as urban and cultivated areas, their introduction into natural habitats represents a threat to the conservation of biodiversity and ecosystems services. That is the reason why, in natural areas throughout the country, the populations of the most dangerous alien species, such as tree of heaven (*Ailanthus altissima*) and black locust (*Robinia pseudoacacia*), must be carefully monitored and immediately controlled or eradicated when the species begins to change the ecosystem in a consistent and potentially irreversible manner.

The alien plant species found in Apulia represent about 7% of the regional flora. The number of alien species is not so high compared with that of other Italian regions, especially considering the widespread presence of man in the territory, the lack of natural vegetation coverage, and the poor extension of woodlands, generally more resistant to the infiltration of alien species. It seems plausible that regions such as Apulia, with a strong Mediterranean climate with remarkable summer drought, constitute an area difficult to colonize by allochthonous species, but for those coming from other Mediterranean regions. It must be highlighted how the number of alien species is directly proportional to the anthropization degree in the territory, as the depletion of natural and native vegetation and the consequent reduction of competition are key factor in the spread of alien species.

Main invasive species

Ailanthus altissima (Mill.) Swingle

Common name
Tree of Heaven

Etymology
The name *Ailanthus* has Malaysian origin; it means "tree reaching the sky"; the epithet from the Latin *altissimus* indicates the considerable plant height.

Origin
Ailanthus is native of China. The plant was brought to England by the Jesuit missionary R.P. d'Incarville, a scholar of Chinese flora. It was introduced into Italy in 1760 at the Botanical Gardens of Padua and cultivated for the breeding of Ailanthus sphingidae. This practice was later abandoned, but the use of Ailanthus was not, because the plant was appreciated for its aspects such as rapid growth, its hardiness and pest resistance.

Main morphological characteristics
The species is deciduous, erect and with expanded branching. The trunk has an average height of 15 m but can also reach the height of 30 m and 1 m in diameter. It has a smooth, light gray bark that becomes coarse with age. The reddish or brown stems are straight and smooth, covered with a light bloom. The leaves are alternate, compound, odd pinnate or even pinnate, up to 60 cm long. Single leaves are lanceolate, smooth and has a rather unpleasant odor, so as the bark and the new sprouts. The inflorescences are apical panicles of 10-20 cm, usually containing unisexual single flowers with 5 small green-yellowish petals and sepals. The fruit are reddish

or brown samaras, depending on the maturation degree, 3-4 cm long and 1 cm wide with a single central seed.

Flowering season

January	February	March	April	May	June
July	August	September	October	November	December

Dissemination and environmental risk

Ailanthus has spread around the world. It is found in the plains and hilly-mountainous areas between 800 and 1200 m. a.s.l. in Australia, North America, New Zealand and all Europe member states. In Italy, Tree of Heaven is the most common and threatening species in all the regions, including Apulia.

A. altissima has spread abundantly because of its ability to colonize and invade new environments by the production of a very high number of seeds whose winged shape favours their transport by the wind up to hundred meters from the mother plant. Ailanthus reproduce equally well through vegetative reproduction by root suckers, increased by cut or fragmentation of stems or roots.

The species typically settles in areas subject to human disturbance, among ruins, along roadsides and railways, but it is able to grow in any type of environment also natural, where it tend to replace other species, forming very dense, monospecific populations, which release compounds that inhibit the growth of other species. The toxic substances that the species produces discourage consumption by herbivores.

Mechanical control (cut) is not effective and even worsening, since it stimulates the formation of sprouts from the roots.

Use and distinctiveness

In the second half of 1800s ailanthus cultivation spread to be used for the breeding of a type of silkworm (*Samia Cynthia*). Thanks to its speed of growth and hardiness, the species has been used in the past as an ornamental and reforestation plant. Although the plant is slightly toxic (contact with leaves and flowers can cause allergic reactions such as skin irritation and dermatitis) and roots, leaves and bark decoction is bitter, the species was used in traditional Chinese medicine for its antiseptic and anti-diarrheal

properties. Moreover, the leaves are used in the paper industry and to give a yellowish tint to paper.

Amaranthus spp.

Common name
Pigweed

Etymology
It comes from the Greek *a–mariano,* which means *don't wilt* because of the calyx and the bracts seem not to wither.

Origin
Mexico and Central America

Main morphological characteristics
Pigweed is an annual herbaceous species. The **stem** is erect and reddish at the base, its height is variable from 0.5 to 3.5 m, depending on the species. The **leaves** are alternate on the stem. The petiolate leaf is ovoid to lanceolate. **Flowers** are red, green or yellow, gathered in upright or hanging spikes clusters up to 100 cm in length. **Seeds** are very small, round, flattened and milk-white to yellow to black in colour.

Flowering season

January	February	March	April	May	June
July	August	September	October	November	December

Dissemination and environmental risk
The genus Amaranthus includes about 70 species, distributed all over the globe. In both urban and agro-ecosystems it is highly present both in qualitative terms (number of entities) and in quantitative terms (number of individuals and population size). Amaranths capacity to spread is related to the high adaptability of the different species, allowing them to easily occupy wide open semi-natural spaces. The damages caused by the invasion of Amaranths is mostly economic, because of its abundance in cultivated fields.
The most invasive species is *Amaranthus retroflexus* L. or common pigweed, found mostly in cultivated, uncultivated and ruderal areas, along

river banks, up to 900 m a.s.l. The other species of the genus are naturalized or accidental.

Use and distinctiveness

The plant has noteworthy nutritional properties and its leaves, stems and seeds are edible. The young leaves rosettes have a flavour similar to spinach, rich in protein, lysine and calcium and can be used to prepare soups. Its gluten-free flour is suitable for people suffering for celiac disease and is used for the preparation of snacks, biscuits and bread, mixed with other flours. It is also suitable for obeses and diabetics diet. The plant has a good content of vitamin A and C, calcium and iron salts and has astringent properties.

Arundo donax L.

Common name
Giant reed

Etymology
The genus name comes from the Latin *(h)aruno*, which could be derived from the Celtic *aru*, water. The species name comes from the Greek *donax*, cane.

Origin
Probably native of western Asia. It is present in Italy probably from the beginning of the fifteenth century.

Main morphological characteristics
Arundo donax is a perennial herbaceous species with a dense, woody rhizomes system with numerous roots, and high and woody stems. The **stems**, covered by leaf sheaths, vary in height from 4 to 6 m and have a diameter of 1-2 cm. They are erect and divided into full nodes and empty internodes. The **rhizomes** have buds from which new stems and rhizomes develop. The root system is capable of extending up to 140 cm. The **leaves** are lanceolate-linear, greyish-green, with smooth or rough edges and sharpened tip. The **fruit** is a caryopsis. The gold / light brown flowers occur in long, dense panicles of 40 to 70 cm.

Flowering season

January	February	March	April	May	June
July	August	September	October	November	December

Dissemination and environmental risk
Archaeophyte plant introduced into Europe for productive and ornamental purposes. *Arundo donax* can cause profound changes to natural ecosystems by altering hydrology, nutrient cycling and vegetation structure. In literature, it is often described as a species that can increase the risk of fire, and also as "fire adapted" because its roots can generate new stems and

re-colonize the areas after a fire event. The plant spreads along canals and ponds, where it causes the disappearance of native vegetation. The propagation is exclusively vegetative by stem cutting or rhizome, since *Arundo donax* caryopsis do not mature in our climates and the few seeds produced do not germinate.

Use and distinctiveness

Arundo donax is still cultivated for erosion control, as a wind barrier and as biomass source for energy production. The stems are used for the construction of fences, trellises, canopies, fishing rods, walking sticks, baskets, etc. The stems are suitable support for vines and vegetables, as their silica content renders them resistant. In the past plants were used to make arrows and wind instruments such as bagpipes and the Pan flute, consisting of different sized canes. Still today, reeds of wind instruments are made with *A. donax*. In traditional medicine, the plant is used to stop lactation and to treat colds. Moreover, its rhizome has diuretic properties.

Xanthium spinosum L.

Common name
Spiny cocklebur

Etymology
The genus name comes from the Greek *xanthos*, yellow, because of the yellow dye it produces. The species' name refers to the presence of thorns.

Origin
South America

Main morphological characteristics
Cocklebur, is an herbaceous annual neophyte plant with **stems** from 20 to 80 cm high, with taproot. **Leaves** are alternate, petiolate, rhomboidal, gray and with a hairy underside. Yellow, threeforked thorns are at the base of leaves. The species is monoecious: male and female **flowers** are both present on the same plant, but separately. The male flowers have tubular corollae while the female ones have none. The **fruit** is ellipsoidal, covered with reddish hooked thorns, 3 cm long and containing two seeds with two sharp ribs on top.

Flowering season

January	February	March	April	May	June
July	August	September	October	November	December

Dissemination and environmental risk
X. spinosum is classified as a harmful invasive plant in most of the areas in which it has been introduced. It produces seeds with a high germination and survival rate, which, thanks to their spiny structure, are easily transported both by animals and man, thus facilitating their dispersion. The plant thrives readily in disturbed soils such as pastures, ruderal and uncultivated areas; it competes with crops such as soybeans and cotton; its seeds and seedlings are poisonous to livestock, especially pigs and horses.

Use and distinctiveness

Toxic officinal species. The plant was used in the past against bronchial catarrh and leprosy. Today it is still used to dye fabrics yellow and as a hair bleach.

Robinia pseudoacacia L.

Common name
Black locust

Etymology
The name is dedicated to Jean Robin, 16th century herbalist, chemist, skilled horseman, and curator of the Botanical Gardens of the King of France.

Origin
It was imported from North America in the early 1600s and introduced into Italy in 1662 into the Botanical Gardens of Padua.

Main morphological characteristics
Deciduous tree, up to 25 m high. The stem is straight and cylindrical, the bark is gray and thick, furrowed with deep vertical ridges. The branches are prickled. Leaves are alternate compound odd-pinnate, up to 30 cm long, consisting of 13-15 segments. The flowers are fragrant and numerous, white or more rarely pink, gathered in pendulous racemes up to 25 cm long. The fruit is a flat, red-brown legume, 5-10 cm long with small dark seeds (from 3 to 10).

Flowering season

January	February	March	April	May	June
July	August	September	October	November	December

Dissemination and environmental risk
Black locust is a very fast growing species. It reproduces by vegetative means. It is tolerant to various soil and climate conditions and is thus found in numerous environments. It is a pioneer species; it rapidly develops dense thickets that modify the structure and floral composition of the invaded areas. Although mainly found in disturbed environments, it can also spread into sheltered and open woodland environments. It has strong spines and its pollen has a strongly allergic effect.

In Apulia black locust is considered naturalized and its spread is limited by climatic factors: the species, in fact, prefers temperate climates and greater coolness and humidity. On the other hand, it is a strongly invasive species in many other regions.

Use and distinctiveness

Officinal edible plant. It was used since the 1600s for its ornamental flowers and foliage. Later, it was used to consolidate steep terrain, road and railway embankments and as urban plantings because of its hardiness and resistance, rapid growth and strong roots. Black locust is also used to improve poor soils enriching them with nitrogen, due to a symbiotic root bacterium belonging to the genus *Rhizobium*. Its highly durable wood has exceptional mechanical strength and is used in carpentry.

The flowers are used in herbal medicine for their calming effects, as an antispasmodic and as an astringent. Its plentiful nectar provides an excellent production of a delicate, fluid honey.

Sorghum halepense L.

Common name
Johnson grass

Etymology
The genus name, although uncertain, may come from an Indian word or from the name of a species. The specific name indicates its area of origin, i.e., Aleppo (Syria).

Origin
Africa and Asia. Its entry is related to the importation of impure seeds for rice crop.

Main morphological characteristics
A perennial herb with a robust creeping underground rhizome. The **stem** is erect, has a height ranging from 30 to 180 cm, **leaves** are 1-2 cm wide and their blades are rough with sharp edges. The **inflorescence** is a wide pyramidal panicle with branches, formed by 4-6 mm long spikelets that contain a single fertile seed with others being sterile. The **fruit** is a caryopsis tapered like a turtle shell.

Flowering season

January	February	March	April	May	June
July	August	September	October	November	December

Dissemination and environmental risk
The species is an archaeophyte, very common in all Italian regions. Widespread in plains and hills between 0-600 m, it is mainly confined to artificial habitats or ruderal areas, and it infests many crops. Because of its rather long flowering period, sorghum produces a very high number of seeds (up to 28,000 per plant) with germination throughout the summer season. Even tilling the soil can cause the plant to spread; in fact fragmented rhizomes can produce a rapidly infesting propagation. For these reasons, the species is considered a pest in agriculture and the cause of considerable economic damages, for both eradication costs and low yield.

Use and distinctiveness

S. halepense is used as fodder in many sub-tropical areas. Thanks to its ability to form extended networks of rhizomes, *S. halepense* can also be useful for the control of soil erosion.

Reported in traditional medicine as a remedy for blood and urinary diseases.

Oxalis pes-caprae L.

Common name
Bermuda buttercup

Etymology
From the Greek *òxys*, acid, and *sal*, salt, referring to the acidic flavour of the plant; the name of the species refers to the plant's root, similar to a goat hoof.

Origin
Africa. The plant has been repeatedly introduced at diverse times and places, either voluntarily or involuntarily, by botanists and collectors. It has been found in Sicily since 1796, from where it spreads into the entire Mediterranean basin in about 50 years' time.

Main morphological characteristics
Herbaceous perennial species, 8-15 cm high. It has underground rhizome stem. **Leaves** are tri-lobed, similar to the 3-leaf clover, with hairy edges and a studded topside; they close at night and open before a rain. **Flowers** are yellow umbrella blooms hanging from a leafless stem. The **fruit** forms a cylindrical pod with round seeds and latticed surface.

Flowering season

January	February	March	April	May	June
July	August	September	October	November	December

Diffusion and environmental risk
This neophyte species is invasive on both crop and non-crop areas up to 600 m a.s.l. Its spread is principally vegetative by means of bulbs, that leads to uncontrolled propagation in plowed fields, in addition to its high resistance to herbicides. The dense root systems strongly compete with indigenous species for light and space. *O. pes-caprae* is common in the entire Mediterranean basin with its mild climate. It is found almost throughout Italian regions on plains and in hills.

Use and distinctiveness

O. pes-caprae is a medicinal and edible species. It can be used in fresh salads. With its high oxalic acid content, it could be hazardous to people with kidney stones, arthritic joints, arthritis and gout. In the past, it was used as a diuretic, purgative, and to cure skin rashes.

Azarole (*Crataegus azerolus* L.)

Small perennial shrub or tree that can reach a maximum height of 8 m. Archaeophyte species native to Crete Island, it is widespread in southern Europe, North Africa and West Asia. *C. azarolus* is cultivated on a small scale in the South of France, Yugoslavia and Greece. In Italy this tree was cultivated for its fruit since the seventeenth century. Sometimes found in wild, spontaneous form, this thermophilic species prefers sunny hillsides (the same climatic conditions of downy oak and holm oak). It prefers loamy or chalky soils and is highly resistant to drought. The azarole hawthorn is an ornamental, fruiting and medicinal species..

Snapdragon (*Antirrhinum majus* L. subsp *majus*)

Snapdragon is an herbaceous, bushy, perennial species. It is an archaeophyte native of the South-Western Mediterranean region. It is found in all Italian regions. It was cultivated since ancient times. It grows in dry, sunny places, often on walls or on limestone slopes and from sea level to hill country.

Cabbage (*Brassica oleracea* L.)

Herbaceous, perennial, archaeophyte species; it is biennial in the wild form. The use and cultivation of cabbage began in some areas around the Mediterranean and the Atlantic coasts of Europe at the beginning of the classical period (from the first century B.C. to the third century A.D.). The morphological and genetic affinity with the wild species *Brassica cretica* identifies its plausible origin as Mediterranean and Eastern Europe (including Greece, Crete and perhaps Cyprus). From here the ancestral forms were introduced into the Italian peninsula, where they became subjects of special attention and choice. *Brassica oleracea* adapts well to all types of deep soils, well drained, cool, and rich in organic matter. It prefers temperate-cold and wet climates and it is tolerant to cold but not to freezing.

False dittany (*Ballota pseudodictamnus* L. Benth)

Perennial neophyte herb, found among rocks and ruins. It is a native species of the Greek and Turkish islands. Known as "the plant of lamps", as flower calyxes were used as oil-lamp wicks.

Mediterranean cypress (*Cupressus sempervirens* L.)

Evergreen, archaeophyte, native coniferous to the eastern Mediterranean, Crete, Cyprus, and Southeast Asia to Iran. It is cultivated and planted for tree-lines and reforestation. *C. sempervirens* has been known in Italy since Roman times and has spontaneously grown in many places. The Arizona cypress (*Cupressus arizonica* Greene) is also used for reforestation purposes; it is a neophyte originating from warm temperate areas of America and widely used as ornamental species.

Rapeseed (*Brassica napus* L.)

Archaeophyte, accidental or naturalized, native to British maritime areas. It is commonly cultivated and as well easily found growing wild in uncultivated fields, by roadsides, along railways and irrigation canals. Seeds are utilized for the extraction of rapeseed oil. That was used since the thirteenth century for street lighting, while at present it is used as a biodiesel fuel. Seeds belonging to a variety of the same species, called canola, have a low erucic acid content and are therefore used for the extraction of edible oil.

Field dodder (*Cuscuta campestris* Yunck)

Neophyte, parasitic species, native of North America, accidently introduced into Europe in 1900s through contaminated seeds, probably of medical herbs and/or clover. It is invasive to crops as well as to uncultivated areas.

White mulberry and black mulberry (*Morus alba* L. and *Morus nigra* L.)

Archeophytes originating from China. The white "alba" species was introduced into Europe for the breeding of silkworms; the black, instead, was introduced for the production of its flavourful fruits. Plants are very rustic, they easily adapt to any type of soil (clay, rocky, marginal or hilly) curbing soil erosion and blocking landslides. It is actually possible to find very large wild specimens coming from ancient crops.

Jujube (*Ziziphus jujuba* Mill., nom. Cons.)

Archaeophyte, originating from temperate Asia. The species was introduced about 3,000 years ago from China to western Asia, and lately to ancient Greece and Rome. In Europe the distribution area includes the Mediterranean regions where jujube is cultivated both as ornamental species and for its fruits.

Woad (*Isatis tinctoria* L.)

Archaeophyte, naturalized in Apulia region. It has been known and appreciated for its astringent medicinal properties since ancient Rome. Its leaves produce a blue dye used since Neolithic times for tinting linen and hemp fabrics. It was cultivated over time in many Italian regions, but later abandoned because of the importation of Indian indigo (*Indigofera tinctoria L.*). Nowadays its cultivation has been resumed and valued with good results both in France and Italy. It is readily found in uncultivated fields, among ruins, in disturbed soils and along roadsides.

Lupine (*Lupinus albus* L.)

Accidental archaeophyte, native to the Mediterranean Basin and to the Middle East, cultivated since ancient times for its seeds and used for green manure and forage; currently found as a wild species. It prefers loamy, loamy-sandy or slightly acidic soils, poor in limestone.

Apple (*Malus domestica* L.)

Archaeophyte species, obtained by domestication of *Malus sylvestris*. It originated in Central Asia, in today's Kazakistan, where about 8,000-9,000 years ago the nomadic populations began to sow seeds in the neighbouring areas, expanding the cultivation area to the West and the East. Some plants are found randomly growing in remaining of ancient crops.

Quince (*Cydonia oblonga* L.)

Probably originating from the Caucasus, its cultivation is ancient, already present in Greek and Roman times. It was widely cultivated in Central Europe until 1,900s, but the increase in popularity of apple and pear led to its sharp decline. Currently it is still cultivated and sub-spontaneous on the edge of woodlands, in woods and in limestone soils.

Pomegranate (*Punica granatum* L.)

Archaeophyte species, accidental in Apulia region, native of Eastern Europe and Western Asia. Recent studies, including archaeological ones, have determined that the pomegranate was one of the first fruit trees known and domesticated since 4,000 B.C. Its centre of origin is considered the Central Asia, in particular the Trans-Caucasus-Caspian region of Iran. The introduction of pomegranate crops in Italy could date back to the Archaic-Hellenistic period (VI-III centuries B.C.). It is currently cultivated and there are spontaneous specimens escaped from cultivated groves.

Foxtail millet (*Setaria italica* L.P. Beauv.)

Annual grass native to Asia, present in Europe since prehistoric times. It is invasive in Italy, naturalized in Apulia region. Used as rotation crop, *S. italica* is the second most cultivated species of millet in the world. It grows spontaneously in disturbed and peri-urban environments and in abandoned fields.

Russian vine (*Fallopia baldschuanica* (Regel) Holub or *Fallopia aubertii* (L. Henry) Holub)

It has Central Asia origin, and was first introduced into Europe in Spain in 1889 as an ornamental species. It is currently naturalized, accidentally escaping its intended limits. The species grows by climbing on shrubs and trees and can threaten native vegetation. It is a nitrophilic species, found in disturbed sites, on walls and in ruderal areas.

Horseradish (*Armoracia rusticana* G. Gaertn., B. Mey. & Scherb)

Archaeophyte, perennial, herbaceous species native of Eastern Europe. In Italy it was widespread in the past as it was cultivated for its root, which, if ground and preserved in vinegar produces a pungent sauce. Its vigorous bushes grow in ruderal areas.

Canadian horseweed (*Erigeron canadensis* L.)

Neophyte, invasive in uncultivated fields, in ruderal areas and along roadsides. Like other annual Asteraceae species (*Erigeron bonariensis* L. and *Erigeron sumatrensis* Retz), it came accidentally from other continents and is able to colonize rapidly new environments through its ability to produce a large number of seeds.

Jerusalem artichoke (*Helianthus tuberosus* L.)

Accidental neophyte from South America, introduced as food source. It spreads as weed throughout Europe since it easily adapts to different temperatures and it grows in wet, heavy clay soils as well as in its preferred dry, sandy soils. It grows in dense stands in uncultivated and ruderal areas.

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Istruzione Agraria online
http://www.agraria.org

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