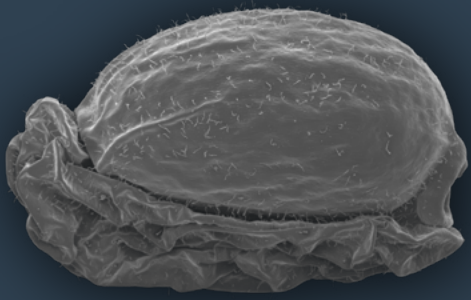
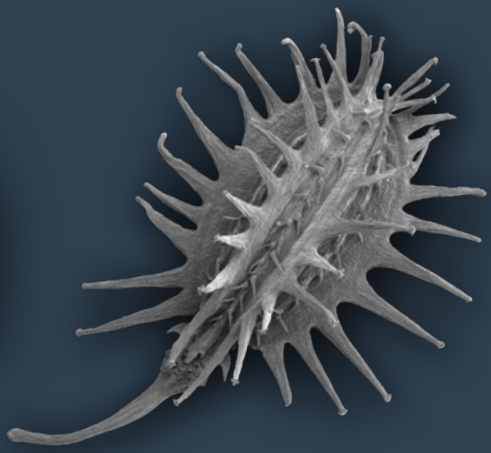
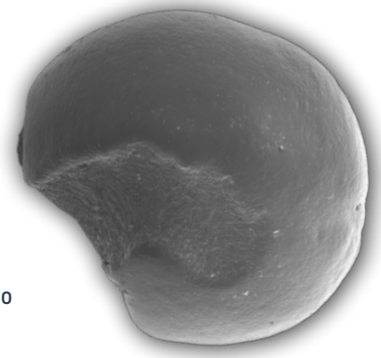
THE INVISIBLE WORLD OF SEEDS





This exposition has been created as a part of the national event of the « Belle saison des CBN » based on the theme of the invisible and showcases the evident partnership between the Conversatoire Botanique National de Corse, a branch of the Office de l'Environnement de la Corse, the Collectivité de Corse, the laboratoire Sciences pour l'Environnement de l'Université and the Centre National de la Recherche Scientifique.

Dive deeply into the world of seeds, through this exposition, and look at what is usually invisible to the naked. When photography is paired with Scanning Electron Microscopes (SEM), we can discover tiny, near invisible details in the forms, structures and ornaments of plants, and how all these assets, who are mostly strategic, allow plants to survive and conquer the surrounding environment.



Our approach aims to underline the different ways in which flora can move. To do this, we chose various indigenous species, found everywhere in Corsica, whose seeds allow us to visualise the flora's movements and let everyone see the invisible world of seeds, thanks to the Scanning Electron Microscopes (SEM).

This way, you will be able to see a global vision of the seeds as well as certain close-ups accompanied by their plates specifying the different elements of the plant. We decided to put only one Corsican name, if it exists, even though it is possible that other names exist. A presentation of our partners and their different tools will come to complete the exposition.

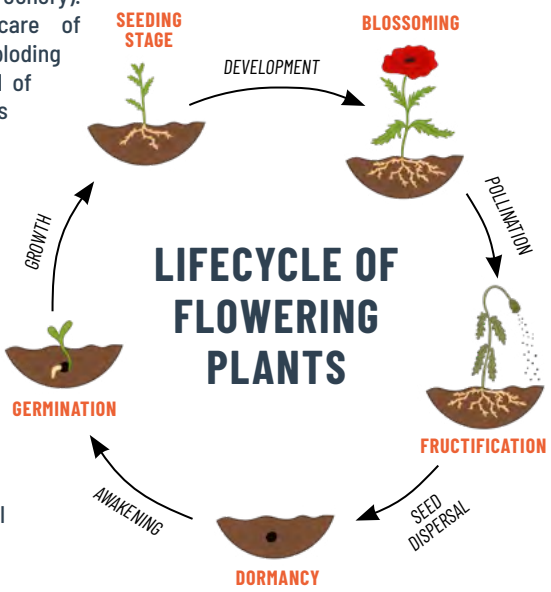
CONTENTS :

THE SEED'S JOURNEY: SYNONYM OF LIFE AND BIODIVERSITY

Angiosperms follow a fascinating life cycle which assures their survival and reproduction. It all starts with the seed's germination: a seed, who has access to water and a heat source, begins to wake up and gives birth to a young sprout. The sprout begins to grow, developing leaves and stems, until it starts to mature. Then the sprout begins to blossom, an important moment where the flowers start to attract pollinating species and can also use the wind to enable its pollination. Once the plant has been pollinated, the flower produces a fruit which contains seeds, which are the promise of the next generation.

The seed's dispersion is a crucial step of the life cycle, allowing the expansion of the species' population and to avoid competition, as well. Some plants use gravity (barochory) or the wind (anemochory), whilst other plants make the most of the animals who consume the fruits and spread the seeds (zoochory), like berries eaten by birds, for example (endozoochory), or plants can also attach their seeds to animal fur, for transport (epizoochory). Water can also be an effective way of scattering seeds (hydrochory). Meanwhile, other species take care of dispersion themselves (autochory) exploding fruits for example. For each method of dispersion, the plant adapts the seed's structure and its ornaments, to be more effective.

Interrupting or tampering these cycles endanger not only the plant, but also the ecosystems which depend on these cycles. The local wildlife feeds itself thanks to the pollen or the fruits and can even find refuge inside these plants. Everything is interconnected: preserving the vegetal life cycles, means guaranteeing the longevity of the local biodiversity.



THE CONSERVATOIRE BOTANIQUE NATIONAL DE CORSE'S SEED BANK: A KEY TOOL FOR THE CONSERVATION OF THE ISLAND'S FLORA

Seed conservation represents nowadays, a major tool for saving the nature's heritage, especially with the rising pressure and threats against biodiversity. The Conservatoire National Botanique de Corse (CBN), a branch of the Office de l'Environnement de la Corse, has for scientific and technical goal, to be familiar with and protect the island's flora. Approved by the Ministère de l'Ecologie, the CBN is a part of the network of national botanical conservatories.

- DEVELOP AND IMPROVE UNDERSTANDING
- MANAGE AND ENHANCE DATA
- CONTRIBUTE TO CONSERVATIVE MANAGEMENT AND ECOLOGICAL RESTORATION
- TO BACK BY SCIENTIFIC AND TECHNICAL EXPERTISE
- INFORM, RAISE AWARENESS AND MOBILISE

Germination test

Study on the germination of Delphinium pictum Willd

Its missions of conservation, led by the constitution of a seed bank with strict criteria, enable the conservation of the genetic diversity of local species (indigenous or not), to secure a stock of seeds of endangered species, to participate in actions of ecological restoration and to support scientific research.

Involved at a national and international level (INRAE, Kew, Jardin et conservatoire de la Ville de Genève etc.) with the network of botanical gardens, seed banks and the conservation of the genetic resources of the Mediterranean flora (GENMEDA), the unit of conservation ex-situ of the CBNC allows the increase of biological and physiological knowledge of species, which is vital against global changes.

The seed bank of Corsica also plays an important role in scientific mediation and raising awareness about the stakes of floral conservation.

THE BOTANICAL GARDEN OF THE CITADELLE DE CORTE, A CONSERVATION TOOL IN OPEN-AIR

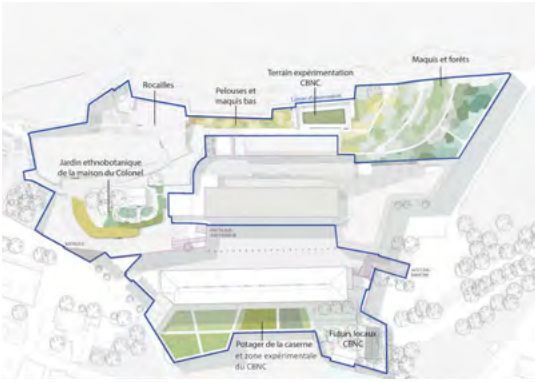
The Citadelle de Corte, a stronghold of the 18th century rests upon a medieval castle built during the 16th century on a rocky headland overlooking the city, is getting a makeover thanks to a project of requalification supported by the Collectivité de Corse and its partners.

Under the name CITADELLA XXIu, this project plans to enhance the site, lodged between nature and culture, and to adapt it to society's evolution all whilst inserting it in the best possible way, into the city and its environment. One of the program's interventions is the promotion of the citadel through a new visiting route mixed with a botanical garden created in partnership with the Conservatoire Botanique National de la Corse (Figure 7). This partnership is the perfect occasion to accentuate what is at stake in the wild flora's preservation on a territorial scale and even more, by integrating this tool into the different international networks of botanical gardens.

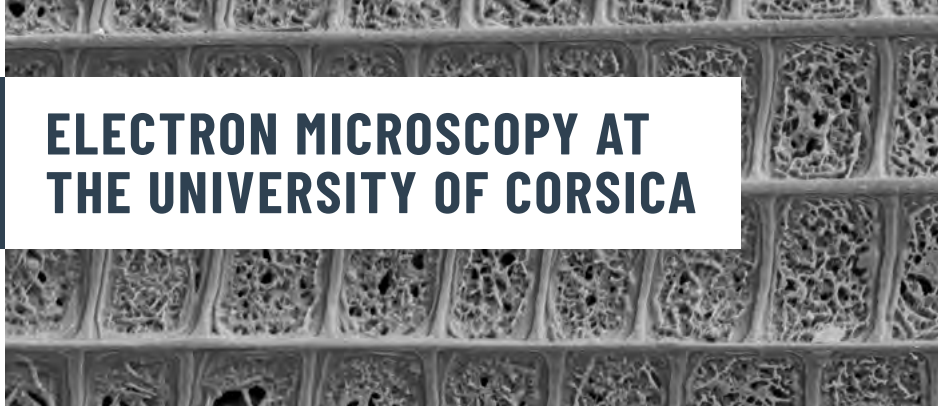
This project wants to maintain the beauty of the architecture and the landscape. The various planted plots will showcase the existing flora of the site and its environment, transforming the different bastions of the military architecture in a genuine sample of Corsica's territorial vegetation.

Intended for the population, these living collections have scientific, educational and recreational vocations, lend themselves to a botanical, ethnobotanical and conservative approach, by including spaces dedicated to experimentation.

The images of seeds presented for this exposition are, mostly, those which will compose the future botanical gardens of the Citadelle de Corte.



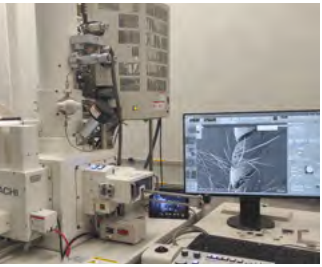
General view of the gardens (©Territoires)



ELECTRON MICROSCOPY AT THE UNIVERSITY OF CORSICA

Transmission Electron Microscope (TEM) (©Université de Corse, service Communication)

Scanning Electron Microscope (©Università di Corsica, service Communication)



Scanning Electron Microscope (©Y.QUILICHINI, Laboratoire Sciences pour l'Environnement de l'Università di Corsica, CNRS)

The first electronical microscope was developed in 1931 by two German engineers, Max Knoll and Ernst Ruska. Ruska had also won the Nobel prize in physics, in 1986, for the discovery he had made 50 years beforehand.

Electron microscopy uses electrons to carry out observations. The difference between « conventional » microscopy, known as photonic, which uses a light source, and electron microscopy concerns the resolving power and magnification levels who are much superior with electron microscopy (as much as 5 million times superior). It allows you to study the ultrastructural level of a sample in multifaceted research projects, with all the images coming out in black and white.

In 2000, the first electron microscope, dating back from the 80s, was installed at the University of Corsica. Nowadays, the University disposes of one Transmission Electron Microscope (TEM), (image 1) and two Scanning Electron Microscopes (SEM) (image 2 and 3) managed by the scientific and technical pole of the laboratoire Sciences Pour l'Environnement.

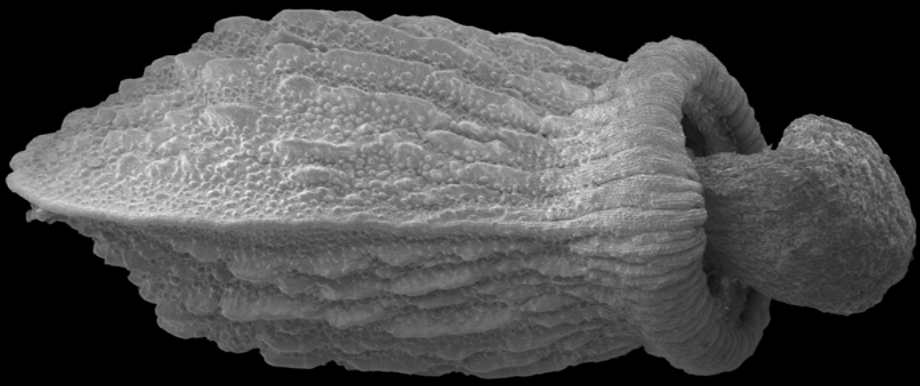
The images presented as a part of this exposition were taken using a SEM. A microscope allows us to observe the surface of the sample with a striking relief effect, which invites the observer to delve into an invisible world, as surprising and as it is inaccessible for our senses.

This work benefited from the support of the Programme d'Investissement d'Avenir de l'ANR «ExcellencES » UNITI and the label « Science Avec et Pour la Société », delivered by the Ministère de l'Enseignement Superieur et de la Recherche at the University of Corsica, which has for objective, to recognise the work of research and science to the public.

Borago officinalis L., Bourrache officinale, Burrascia, Borage

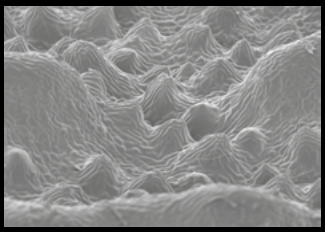
The borage belongs to the family Boraginaceae. It is commonly found in bushlands around urban zones and villages where it was often cultivated for its medicinal properties.

The achene, an indehiscent (unopenable) dry fruit, contains the seed. The seed has an elaiosome, a fleshy structure rich in lipids which ants feed off of. These same ants assure the seed's transport once it has fallen to the ground. This is an example of zoochory and more precisely myrmecochory.

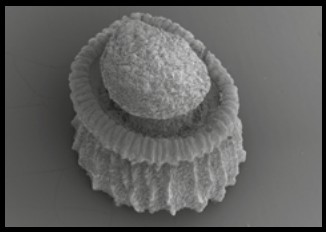


1 mm

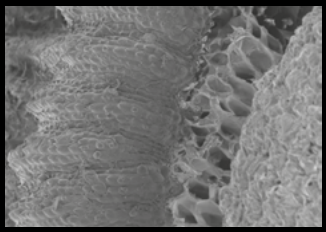
Borage seed and its details



50 µm



1 mm

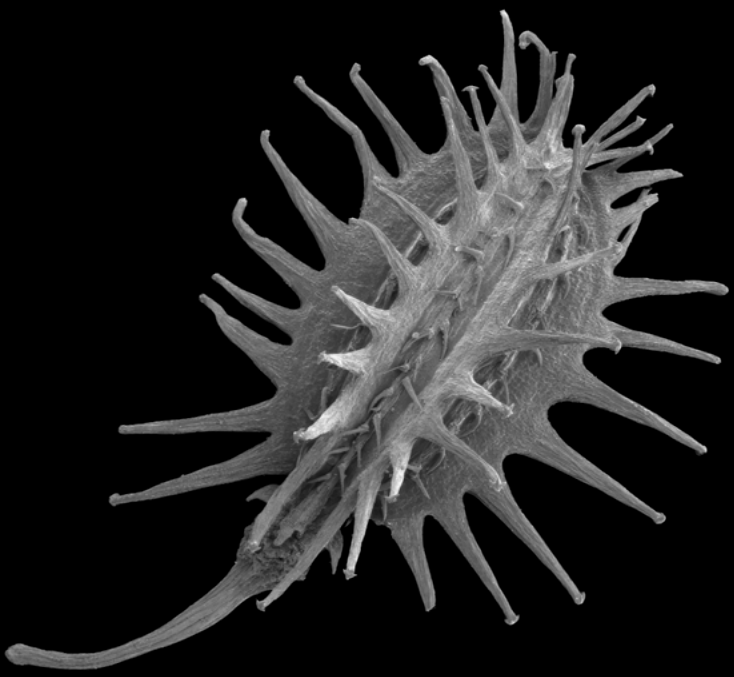


150 µm

Daucus carota L., Carotte sauvage, Pastinacciu, Queen Anne's Lace

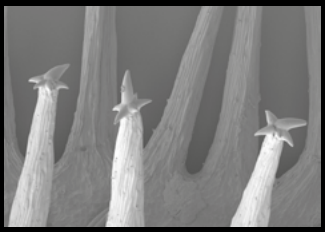
The queen Anne's Lace belongs to the family Apiaceae (ex. umbellifers). It is very common in many different environments: coastline, meadows and pastures, bushlands and cultivated fields, open maquis. The tiny white fleurs are united in an umbel (inflorescence forming a « plateau » from which all the floral stalks stem from) where, in the middle, can be found an infertile dark-purple flower, acting as a marker for pollinating insects.

The cell wall surrounding the seed is punctuated by long spurs ending with little hooks. This apparatus allows the seed to cling to different animals' fur, or even passer-by's clothes, to ensure the seed's dispersion. This is an example of zoochory and more precisely, epizoochory

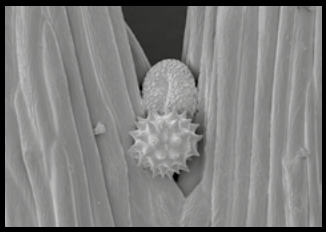


1 mm

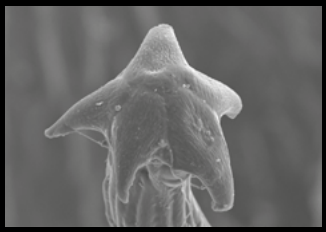
Queen Anne's Lace seed and its details



150 µm



20 µm

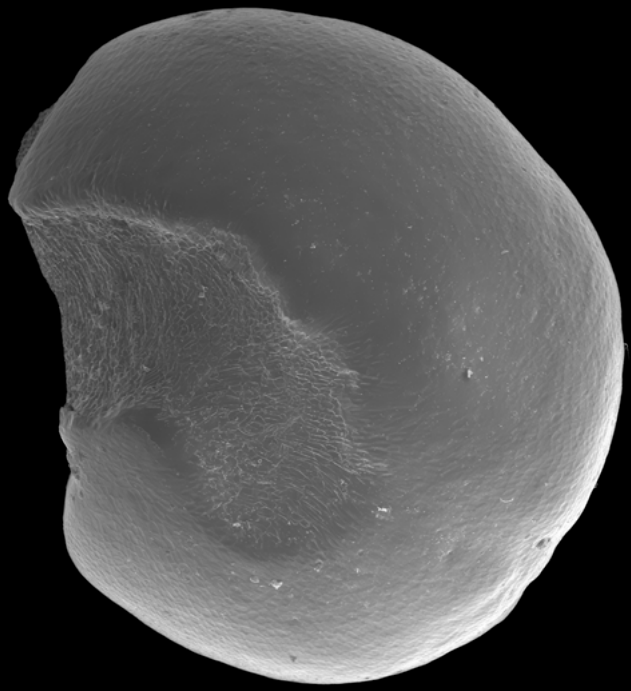


25 µm

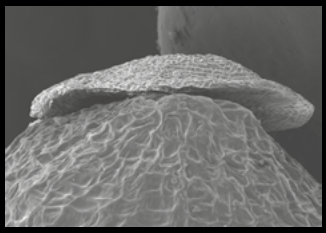
Myrtus communis L., ., Myrte commun, Morta, Myrtle

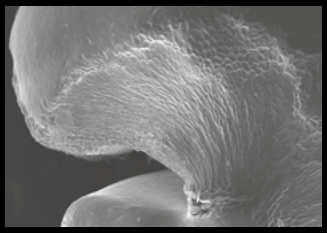
The myrtle is a species in the myrtle family Myrtaceae. It is a very common shrub in the warmest shrublands of Corsica near the coastlines until 400m of altitude. It is well known for its various traditional uses (liqueur, basketwork etc.).

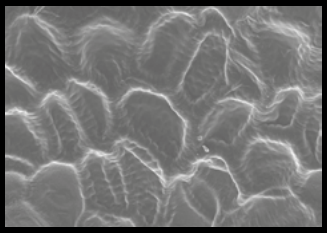
Its seed are contained in a berry, that is dark blue at maturity, and these berries are primarily eaten by birds (particularly Sardinian warblers) who ensure the seed's dispersion through their faeces after the fruit's digestion. This is an example of zoochory and more precisely endozoochory.



Myrtle seed and its details



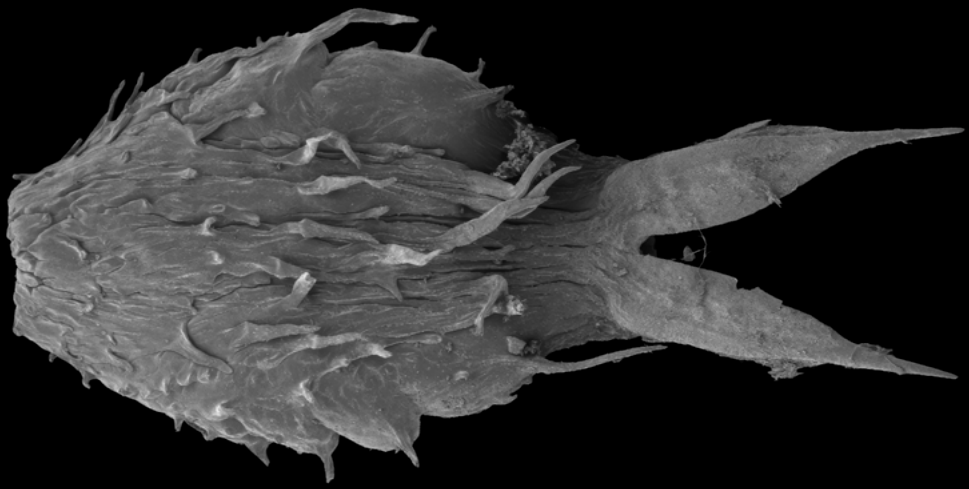




Eryngium maritimum L., Panicaut maritime, Cardu maritime, Sea holly

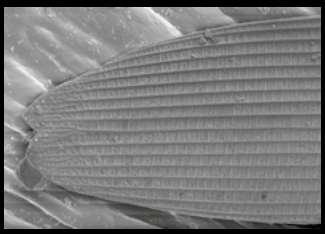
The Sea holly belongs to the family Apiaceae. It is very common at the top of beaches and in beach dunes. This plant is usually used as an emblem, to the logo of the Conservatoire du Littoral, a public establishment who protects the coastline by property control.

As all the species from the Apiaceae family, the fruits are joint two by two. The seeds are surrounded by a sponge-like tissue which allows them to float and be transported by the sea courants but also by the wind. This seed is an example of hydrochory and anemochory.

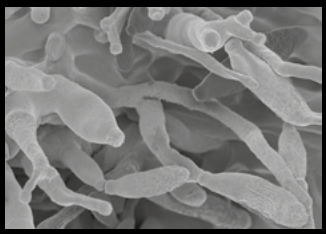


2,5 mm

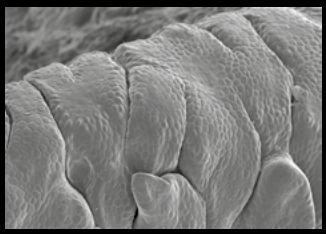
A Sea holly seed and its details



10 µm



10 µm

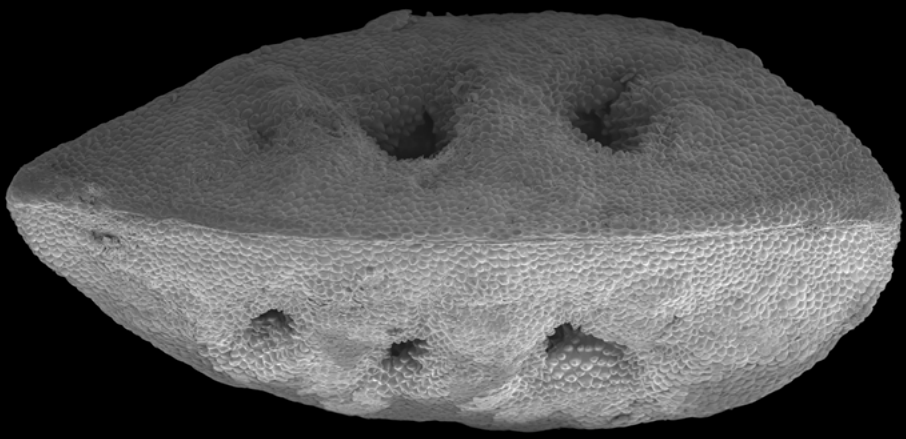


300 µm

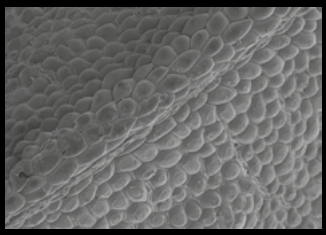
Asphodelus fistulosus L., Asphodèle fistuleux, Hollow-stemmed asphodel

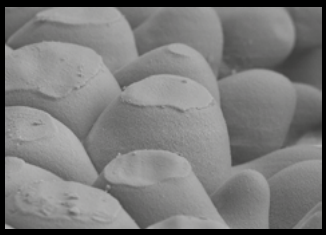
The hollow-stemmed asphodel belongs to the family Asphodelaceae. It is not very common and disseminated in bushlands, on lawns, on the side of the road, often near urban zones. It looks like a smaller model of the well-known Asphodelus, known in Corsica as U luminellu, u taravellu...

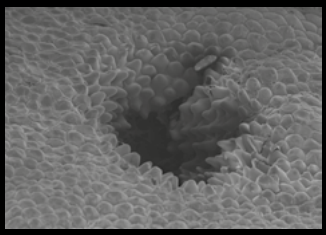
The seeds are fusiform and extremely light, which allow them to be easy transported by the wind. It is an example of anemochory.



Hollow-stemmed asphodel seed and its details





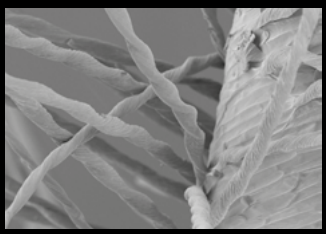


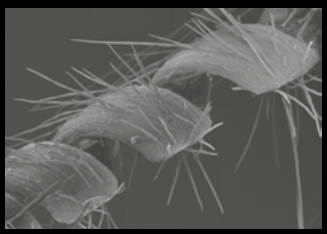
Erodium corsicum Lèman, Bec-de-grue de Corse

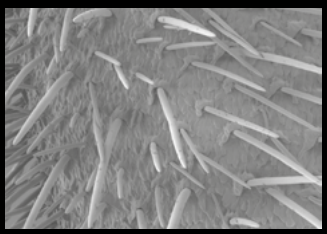
The « bec-de-grue de Corse » belongs to family Geraniaceae. Endemic to Corsica and Sardinia, it grows on coastal rocks of the west coast of Corsica, mostly between Calvi and Aiacciu, but also in the Bunifaziu region.

The tip of the fruit bends itself using hygroscopic movements (dependant on humidity levels), to eject, anchor and dig its seed into the ground, just like a corkscrew. This is an example of autochory.

« Bec-de-grue de Corse » seed and its details



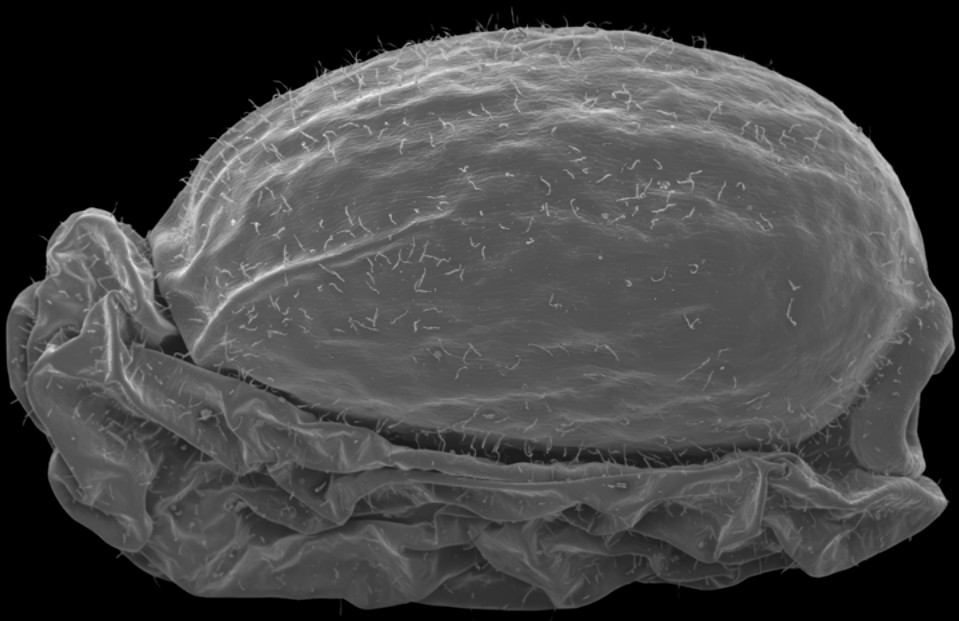




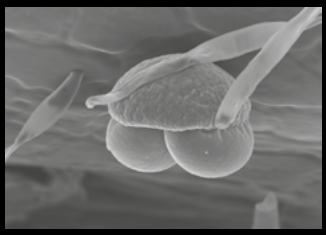
Helleborus argutifolius Viv., Hellèbore de Corse, Nocca, Corsican hellebore

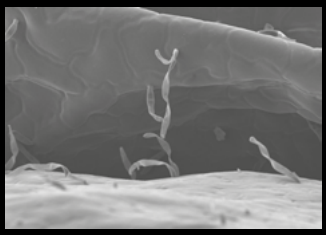
The Corsican hellebore belongs to the family Ranunculaceae. Endemic to Corsica and Sardinia, the Corsica hellebore is very common in the forests and shrublands on the inside of the island. It is well known for its traditional uses.

The seed is equipped with a very important elaiosome. This plump excrescence is rich in lipids which ants feed off of, and these same ants ensure the seed's transport once it has fallen to the ground. This is an example of barochory and zoochory, and more precisely de myrmecochory.



Corsican hellebore seed and its details

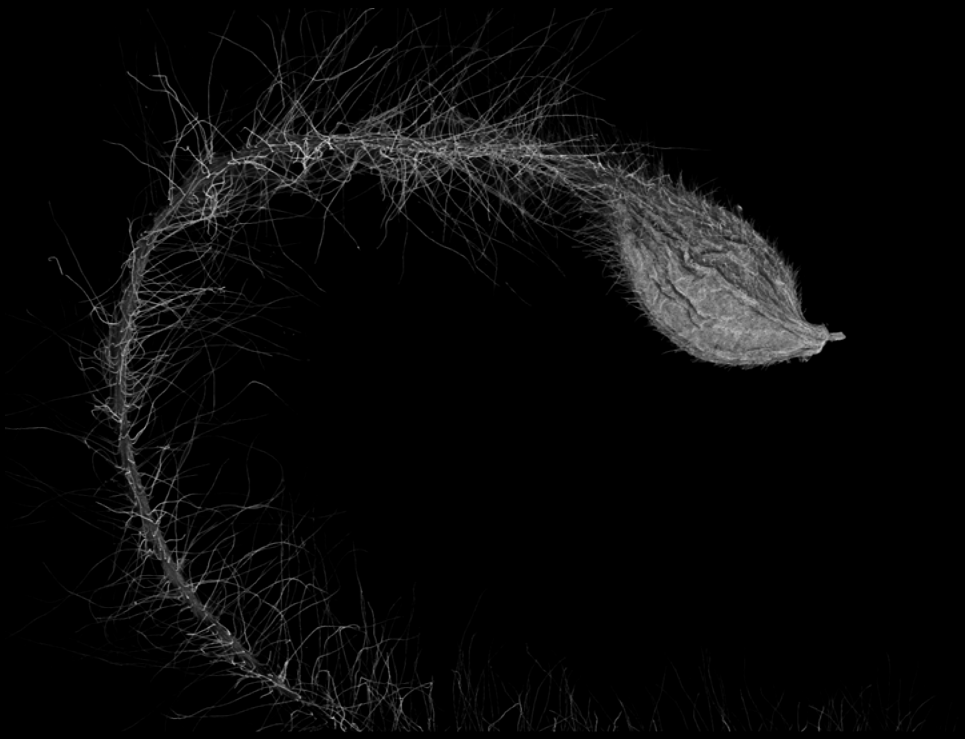




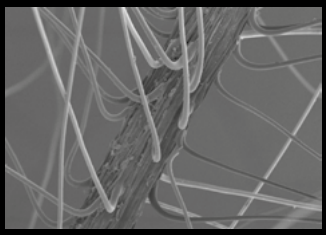
Clematis vitalba L., Clématite vigne-blanche, Vitalba, Traveller's joy

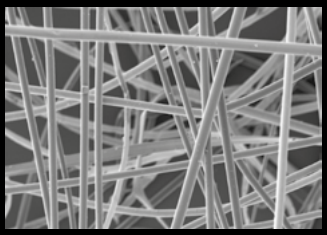
The traveller's joy belongs to the family Ranunculaceae. This vine is common in riverside forests where it climbs up trees, growing up until 10 metres.

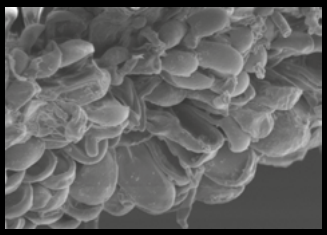
The seed extends itself with a long stalk covered with small hairs, which allows the seed to be carried by the wind for great distances. This is an example of anemochory.



Traveller's joy seed and its details





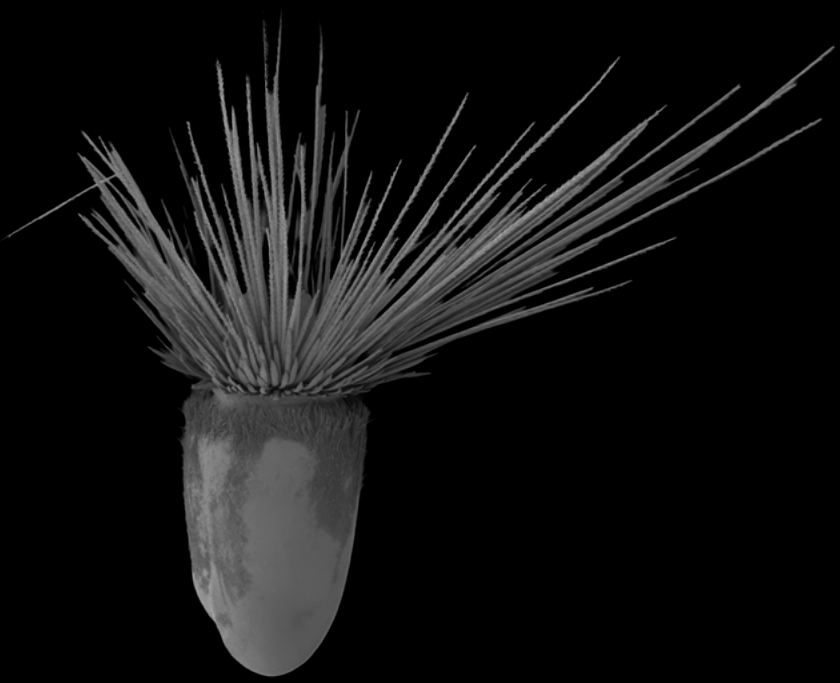


© J.-P. Dalmas, CBNA

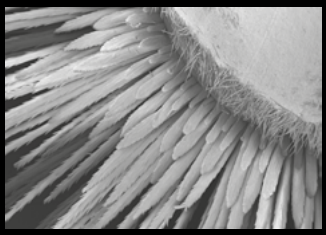
Crupina crupinastrum (Moris) Vis., Crupine du Midi

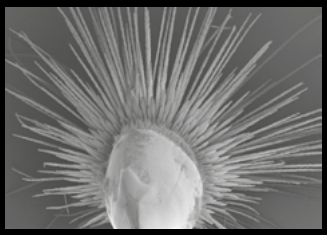
The « crupine du Midi » belongs to the family Asteraceae. It is a small plant, commonly found in low shrublands and dry lawns. It blossoms around springtime with a pretty purple flower which looks like cornflower's flower.

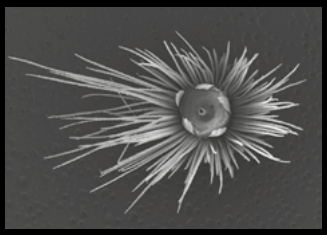
Its seed is contained within an achene, an indehiscent (unopenable) dry fruit, endowed with an organ particular to the Asteraceae, and a few close families, the pappus, a crown of long hairs. This seed can be dispersed in differents ways, whether it be the wind, animals, gravity ... . This is a great example of heterochory.



« Crupine du Midi » seed and its details



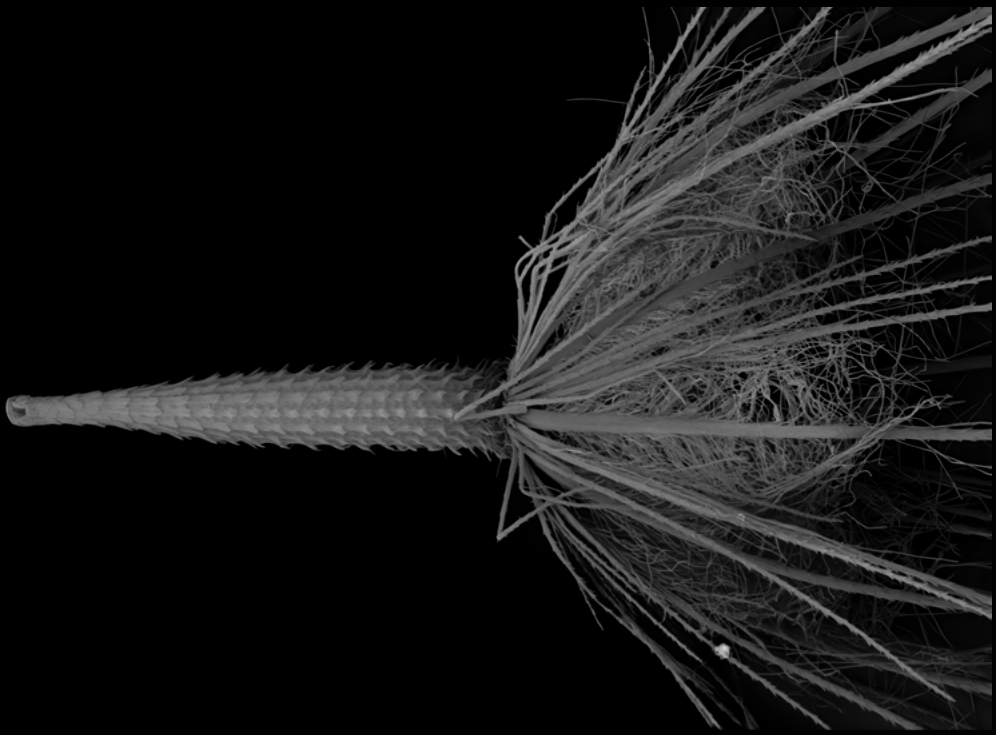




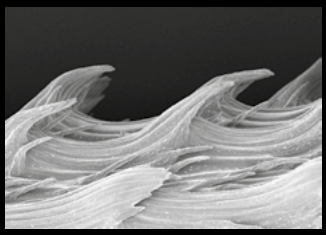
Hypochaeris glabra L., Smooth cat's ear

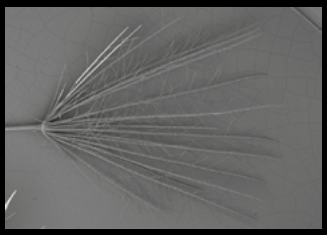
The smooth cat's ear belongs to the family Asteraceae. It is a small plant, common in low shrublands and lawns. Its yellow flower looks like the dandelion, which is a similar species.

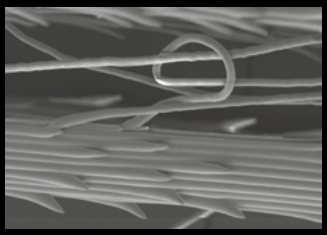
Its seed is contained within an achene, an indehiscent (unopenable) dry fruit, endowed with an organ particular to the Asteraceae, and a few close families, the pappus, a crown of long hairs. The pappus' structure allows the seed to be transported by the wind on long distances. It is an example of anemochory. 2 different types of pappus can be encountered : a low-built pappus, which can be seen in the general view, which allows a dispersion for medium distances, and a long pappus (photo in the middle) which allows for long distance transport.



Smooth cat's ear seed and its details



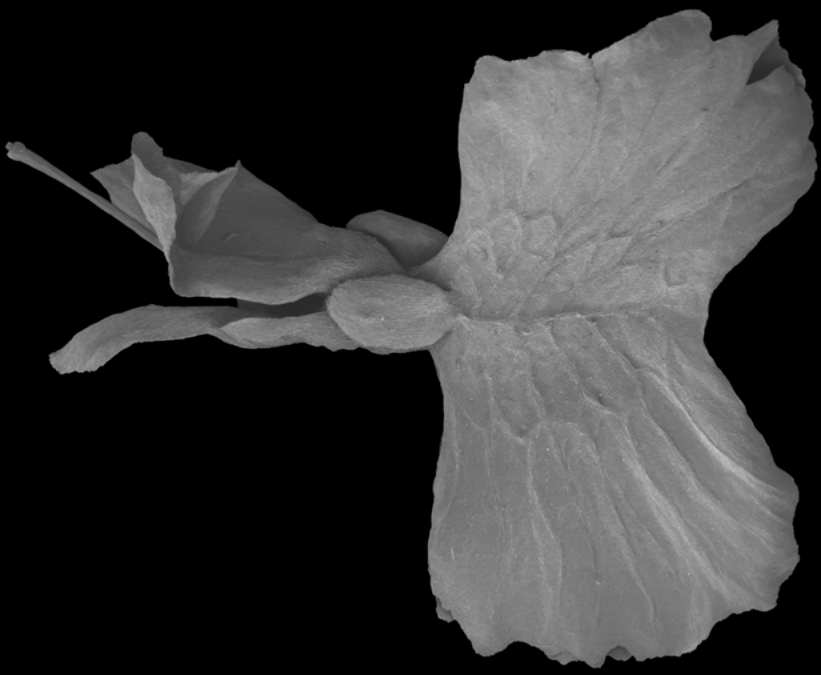




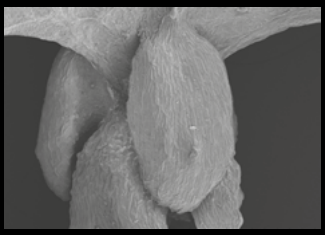
Rumex thyrsoides Desf., Oseille à faux thyrse

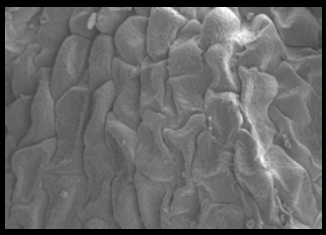
The « Oseille à faux thyrse » belongs to the family Polygonaceae. It is a plant close to the cultivated sorrel, which is rather uncommon, can be found in the bushlands and lawns, often by on the side of the road, in Balagne, the Corte Region and the south of the island.

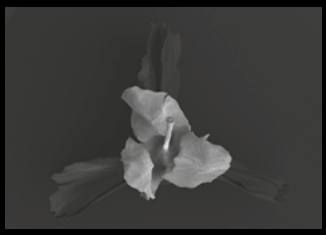
The seeds are grouped together by 3 on a fruit which presents some winged membranous expansions, allowing the seeds to be transported by the wind. It is an example of anemochory.



« Oseille à faux thyrse » seed and its details







THE INVISIBLE WORLD OF SEEDS

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