English edition

Acta Succulenta

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Acta Succulenta

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Cover photo: *Echinocactus polycephalus* subsp. *xeranthemoides,* Marble canyon [S. Baglioni]

EDITORIAL

Once upon a time there was an Epithelantha *so nice and white that it had to be named* “Epithelantha nivea” *(i.e. snow-white). It was like a tiny snowball in the middle of the desert, where the dryness is extreme: what a contrast! And, in these conditions, the plant survived, or even better, actually thrived!*

Once upon a time there was a beautiful child…

Then a phone call: “Ilaria feels very poorly”.

Ilaria, one year old, was suffering a terrible, incurable liver disease, and her health was getting worse every day.

Everybody was powerless; then someone dedicated this Epithelantha *to Ilaria, not as an obituary, but with the hope of these words:*

“Epithelantha ilariae *is dedicated to Ilaria* Montanari*, a young child suffering a very serious illness, and to all the suffering children in the world. We hope in this way that the fight for life of this little plant in its harsh environment will testify that, whatever occurs, Life remains the strongest for ever”.*

Once upon a time there was a beautiful child… and she is still here.

The dedication, the fate, the will to live of the Epithelantha*… the reason doesn’t matter, life remains the strongest. After a lot of troubles and a liver transplant, Ilaria now runs around, is always hungry, and grows and grows … and often she takes a look at the photo of a small cactus fixed to the wall. And one smiles when she makes her parents crazy with her mischief.*

Some children have a lucky star, Ilaria has a cactus, far away in Mexico. She will soon understand that the cactus needs her help. Unfortunately, she’s too young at the moment, so we have to do something now to protect her cactus (and many others).

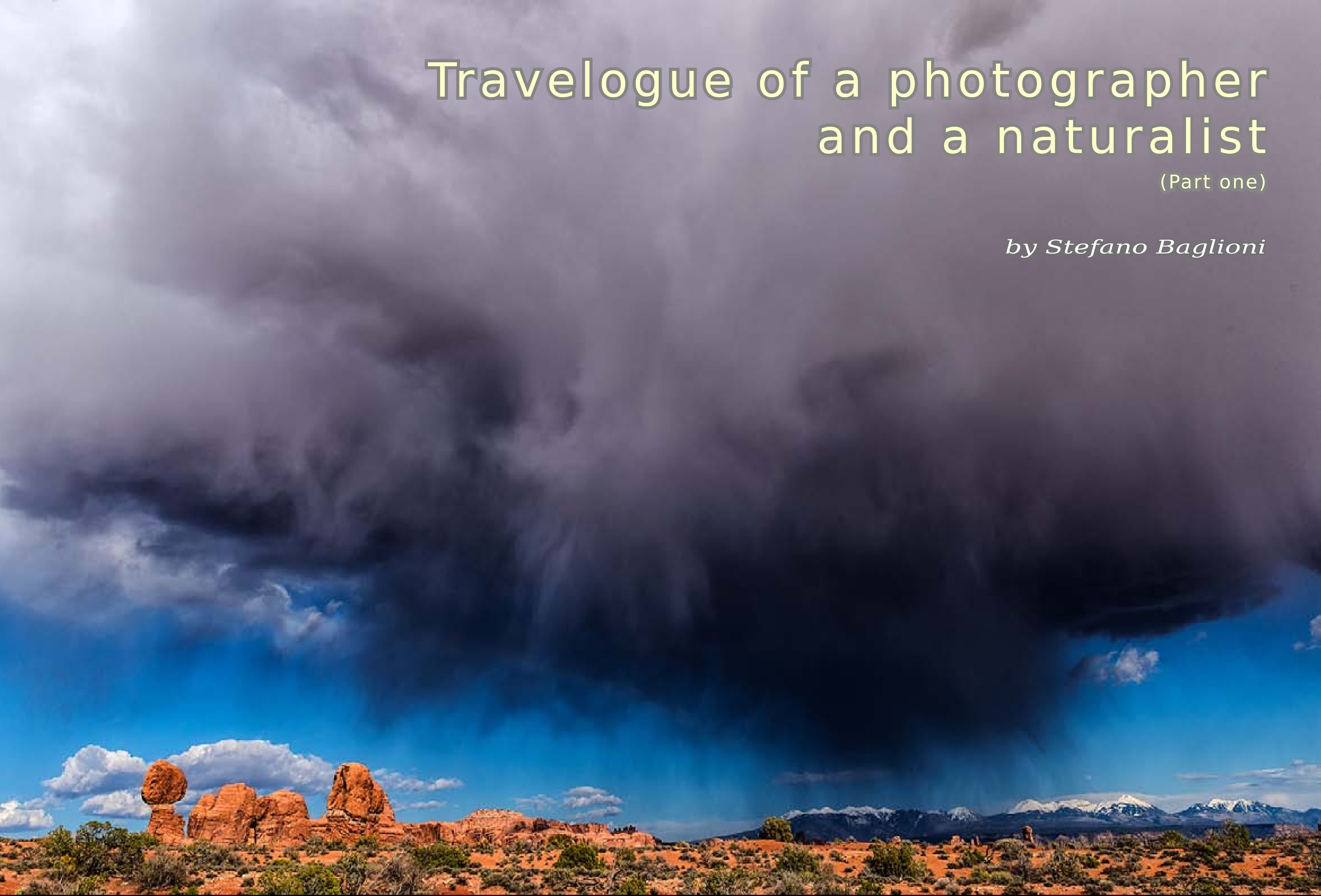
The life of a small white ball, the life of a child, Life...

Davide Donati

Travelogue of a photographer and a naturalist

(Part one)

by Stefano Baglioni



For many years I have spent my spare time in the mountains, at sea or in the countryside, here in Italy, pursuing my hobby: nature photography. Nothing pleases me better than a good shot, where an animal, a plant or a situation shows their true character, their energy and their desire to exist.

Everything was going calmly in my hobby last year. I was photographing owls, insects and landscapes, without any shocks, then a friend, Davide, asked me a question which sent a shiver down my spine "*Hey Stefano, do you want to come with me to the deserts of the SW USA? I need some help*."

In few weeks time I was with him at Bologna airport, with my photographic equipment inside a backpack and a suitcase with few clothes, ready to do something I couldn't even begin to imagine.

But could I decline such an offer?

Bologna-London-Los Angeles.

Our flights could be described as perfect, except for the 'casualty' which was me, always in the middle seat, with Davide, who is not small, on one side, and on the other people always over 100 kg. Considering that my tonnage is not negligible either, the flights were not very comfortable, but that is another story…

Once in Los Angeles I immediately realized what America is all about. Even at the airport desk you realize that everything is big, vast, incredibly tall: a sort of organized chaos for the eyes of a provincial Italian like me, where complex but at the same time very easily navigable highways cross the cities, ready to take you toward the deserts, where the horizon blends with infinity.

Destination Joshua Tree NP, California

The Joshua Tree National Park is an extraordinarily evocative and inspirational preserve, not only for photographers like me.

The journey Los Angeles/ Joshua Tree NP without any stops is no joke if you have just landed in Los Angeles in the late afternoon, but everything was going well, without any problems or almost none (never eat a burrito[1] in a fast food if you don't feel really well…). We reached the gate of the National Park in darkness, so we decided to rest a while in a motel. This was one of the few times where I could rest my head on a pillow, but this again is another story…

Yucca brevifolia

The jet lag, the excitement, whatever the reason was, I could not sleep and I was losing time observing the ceiling of the room. The desire to leave the room was contagious, so we switched our car on and we left the motel, in order to "live" my first American night. I was very excited when I saw my first coyote in the middle of the small town, and then the first imprecations arrived: my photographic equipment was in the room! But this is the game, and of course the memory of a moment is great satisfaction in itself (these are nice words but under the circumstances, I was almost eating my fingers to the nerve...).

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[1] Mexican food made with tortillas, meat, beans and hot pepper.

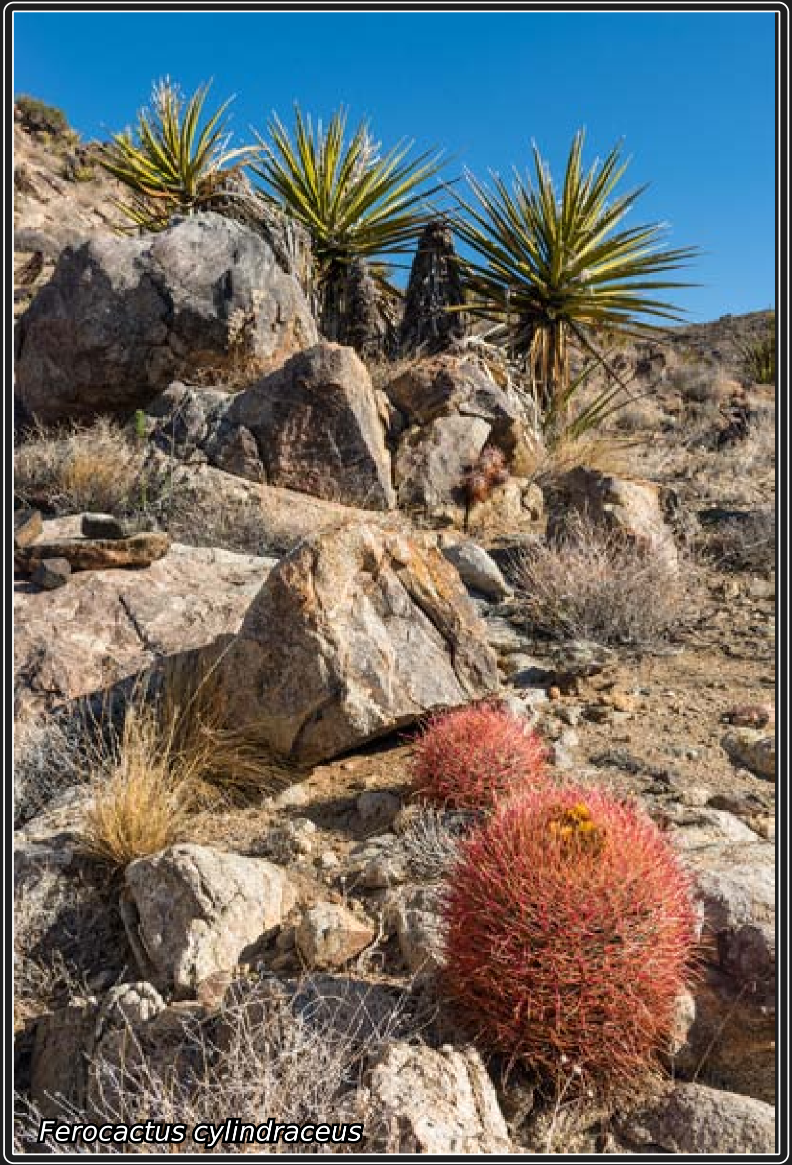
Ferocactus cylindraceus

Yucca schidigera

Finally we felt the need to sleep, but once back in the room; just in time to close our eyes and then the alarm rang: it was 4 AM, it was still pitch dark, but the forthcoming sunrise was calling us. Davide began to understand what it means to have a photographer alongside, but muttering he helped me to load the car with my equipment and the luggage. So, the day begins! (so to speak, it was still night…).

Just at the first ray of daylight, I realized who were the queens there: the xerophytic and succulent plants, prickly guardians of that inviolate peace. While the warm light of the sunrise coloured the adjacent hills and a frosty wind whipped around, the plants showed their colours and forms, with a variety of species which seemed incredible to me: *Yucca schidigera*, *Escobaria alversonii*, *Cylindropuntia ramosissima*, *Cylindropuntia echinocarpa*, *Ferocactus cylindraceus*, *Echinocereus engelmannii*, *Corynopuntia parrishii*, *Opuntia basilaris*, *Echinocereus triglochidiatus* subsp. *mojavensis*…, all just few metres from the car.

Echinocereus triglochidiatus subsp. *mojavensis*



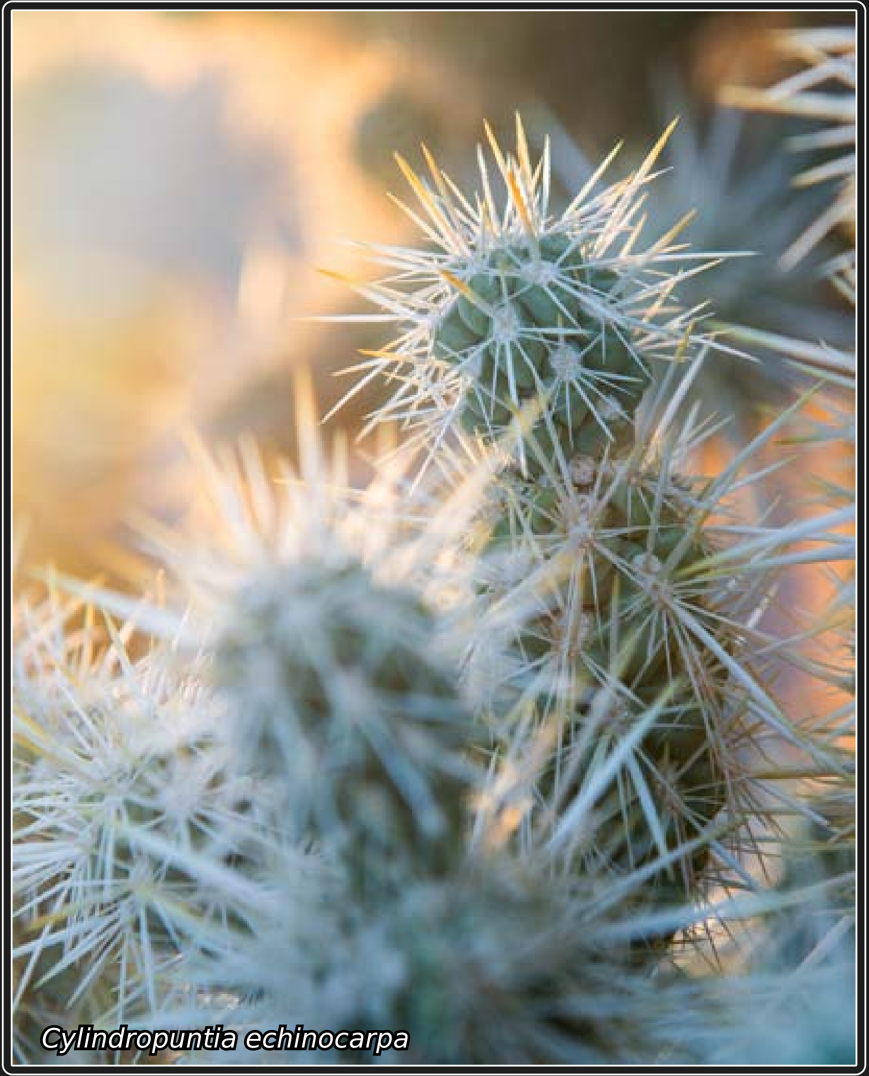
Ferocactus cylindraceus

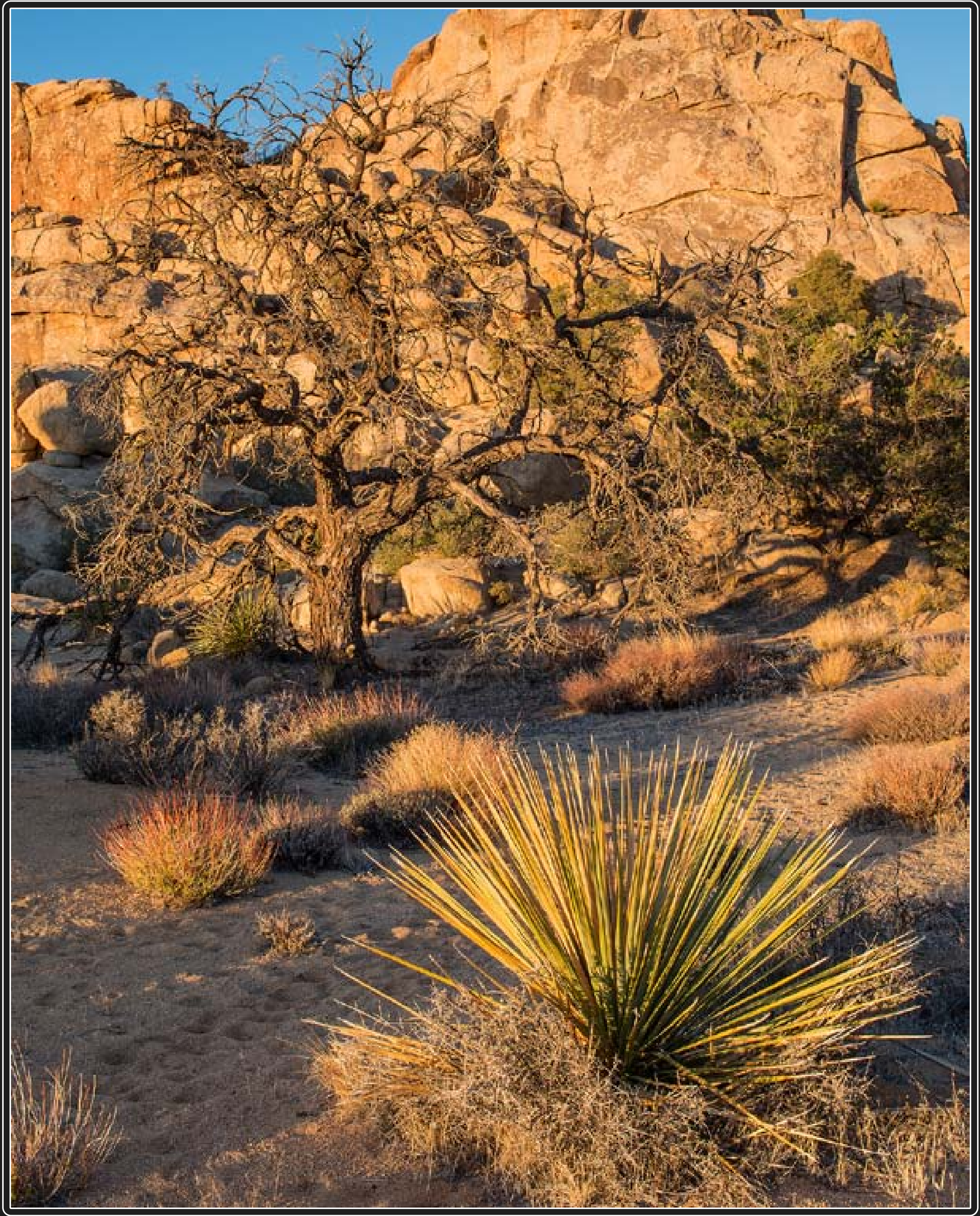
The approach to the Joshua Tree NP left an indelible mark on me, it has been the first desert I visited in my life, and as the Italian saying goes, *"Il primo deserto non si scorda mai"* (The first desert is unforgettable). Ummh, maybe the Italian saying is different, but it doesn't matter.

I will never forget the hours spent observing the magic trees, symbol of the National Park, the Joshua trees, *Yucca brevifolia*, enormous, majestic trees, which, with their twisted form, stand out on the granitic sand, despite the giant rocky monoliths which surround them. By night they became like ghosts illuminated by countless stars which hang over this arid and inhospitable territory.

What an unforgettable memory, that silence is almost worrying…

In that desert I lived unrepeatable moments, with indescribable and satisfying emotions, above all during the night: the howl of the coyote almost froze my blood every time I heard it, the Milky Way that was so clear on that incredibly starry sky, the surprising American badger challenging our car which it followed…


Cylindropuntia echinocarpa



Marble Canyon, Arizona

I left Joshua Tree NP in a sorry state, since I had left something of myself there; I hadn't had enough time to capture in a shot the emotions I experienced.

We were on the way to Marble Canyon now, but the weather was very bad as it was rainy and very cold. The journey was very long and exhausting, not only because of the mileage without any stops, but above all, we had been awake for 30 hours.

We reached our destination just before dark, stopping our car over the white bridge between the two shores of the narrow and deep canyon carved out by the Colorado river: I felt dizzy when I leant from the bridge as I had never seen cliffs so high and steep and I imagined countless photos but the weather was rainy and windy, I had little confidence in the following day…

It was better to rest, hoping for better weather: a true bed was a dream, as another night in the car was waiting for us; that was an almost sleepless night waiting for the next sunrise.

As always, at 4 AM, the alarm rang and we were happy to note that the weather was better and despite the cold it was not raining, so I had the chance to take some shots!

Even in the dark Davide tried to find his plants, he was too excited to wait for the light!

He had told me that there, besides *Echinocereus engelmannii, Opuntia basilaris* (here very big), *Opuntia hystricina* and the rare *Pediocactus bradyi*, we'd be able to see one of the most beautiful cacti he knew, both for its spination and for the extraordinary landscape in which it lives: *Echinocactus polycephalus* subsp. *xeranthemoides*.


Echinocactus polycephalus subsp. *xeranthemoides*

The blue hour(2) was coming, so I could take a look around me: the landscape was exciting, our mood was excellent and we joked and laughed as the new day was emerging. I tried the first shots, but I needed to pay a lot of attention, since the best places were on the edges of precipices, which fell directly into the Colorado River with almost vertical walls of rock, for miles and miles.

So I noticed the king of this place: every time I looked at *Echinocactus xeranthemoides*, I couldn't stop thinking how beautiful they were, probably the most beautiful succulent I had ever seen in my life. They grew exactly on the edge of the precipice, on the gravelly soil and in the cracks of the yellowish-grey rocks: in my eyes they looked like sentinels guarding the canyon. It was a pleasure to photograph them in their habitat, above all when the warm light of the sunrise heated the Vermillion Cliffs, high, red, rocky mountains on the northern side of the valley, creating an incredible contrast of colours between the green of the river, the yellowness of the valley and the red of the mountains. This is true nature photography in my opinion; it has to tell the story of an animal or a plant, capturing in a picture the extraordinary situations of which it's unaware to witness every day. A hard goal, but it's the fulcrum of my passion.

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2 In photographic jargon, "blue hour" means the few minutes in which everything in the landscape takes a bluish -violaceous pattern, and this happen more or less one hour before the sunrise.

The route to Bryce Canyon NP, Utah

It was almost noon, so we had to leave again, since the journey to Bryce Canyon NP was very long and we had planned many stops in order to look for cacti and succulents.

For this reason we stopped close to a population of *Pediocactus paradinei*, a small, rare and slow growing cactus.

We had little time, *Escobaria vivipara* "kaibabensis" and a small form of *Echinocereus engelmanni* weren't rare, but Davide called me, saying that I was surely interested in the thing he had in front of his sandals.


Escobaria vivipara "kaibabensis"


Echinocereus engelmanii

I could not believe at my eyes, a Grand Canyon rattlesnake (*Crotalus oreganus abyssus*), I was living the dream of my life.

The interaction with such a dangerous animal is not so comfortable; fortunately Davide is relatively used to these meetings. *Respect*: this is the word I want to suggest to all who meet a snake, a wonderful animal, but regarded as horrible for the masses.

Aaah, America, how many emotions were you giving me - I really felt I was a lucky photographer.

And we realized that we had forgotten about *Pediocactus paradinei*, 80 miles further away from there.

9th May 2013, Bryce Canyon NP

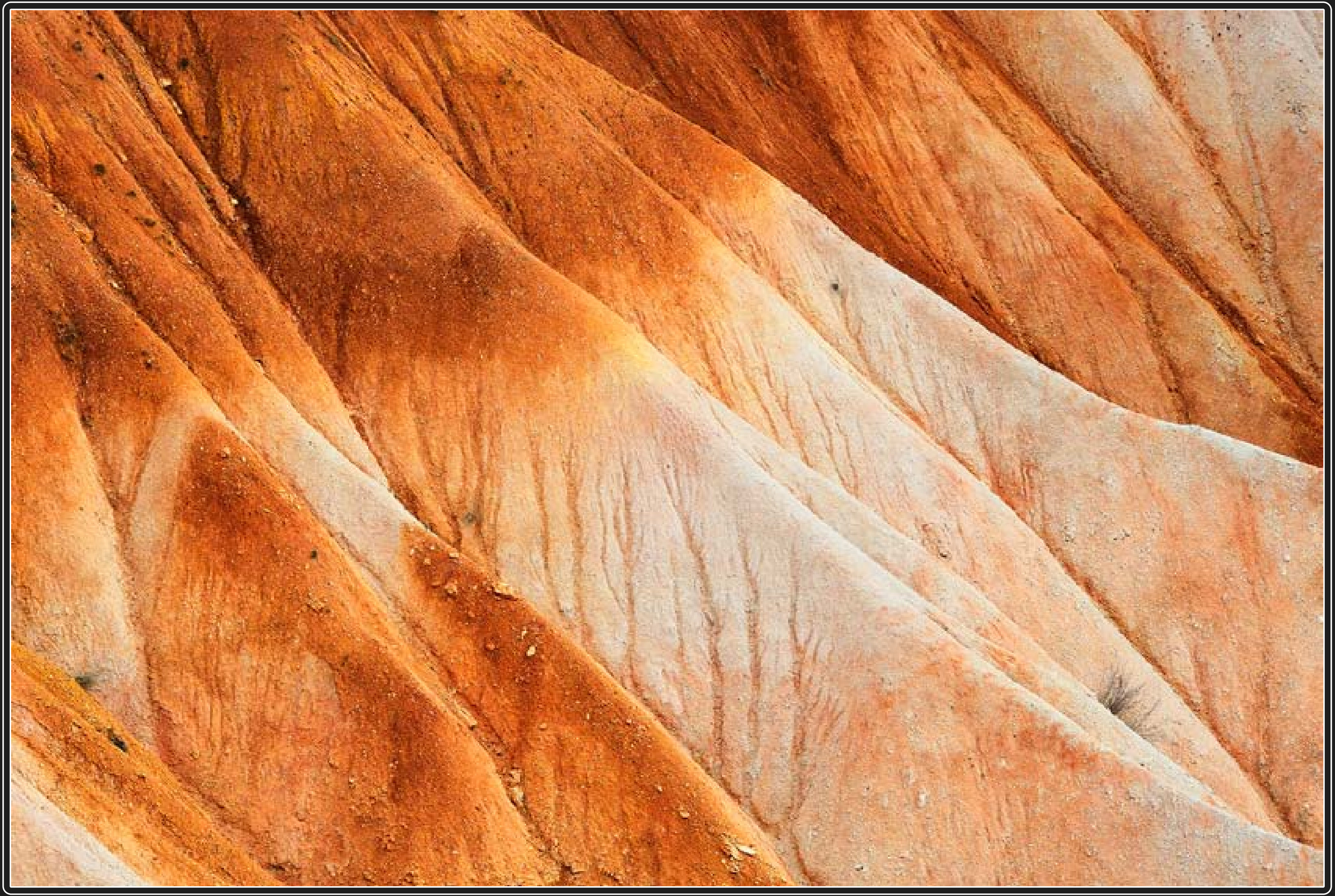
A date to remember as after 4 days I was finally sleeping on a real bed. The weather was rainy so we decided to rest in a motel very close to Bryce Canyon NP, an obligatory stop since it is the location of one of the most beautiful natural rocky amphitheatres in America.

Despite that I was very happy, Davide hated the alarm when it rang at 04:30 AM, we had to wait for the sunrise on that wonderful amphitheater, but what a bad surprise: the weather was rainy and windy, again…

Even in these terrible conditions everything appeared fantastic at my eyes: I could describe Bryce Canyon as an artistic place, full of colours, the various shades of red and grey of the rocks created beautiful effects, almost incomparable.

Also the animals amazed us there, the crows (*Corvus corax*) were very friendly, we could approach them so closely that I used macrophotographic lens, then the pronghorns (*Antilocapra americana*) were walking here and there not in the least bit disturbed by the frequent cars passing along the tortuous roads.

No interesting succulents there for Davide, but he seemed happy.



There I discovered that American people are very friendly and cordial, even with a crazy man who walks among people with a lens 300 f/2.8 (40 cm long) under the rain: fantastic, their comments, *"WOW!" "Wonderful, what a big lens!"*, *"Amazing!"*… I felt like someone from a race of people who has in his hands an alien weapon…

The long way to Arches NP, Utah

Time was never enough for us and we had to leave toward Arches National Park. I already "relished" the sunset on those majestic rocky arches which are the symbol of the park, but the route chosen by Davide, following the road which goes through the big mountain poplar grove, then through the Capitol Reef NP, was a risky choice, since everything was splendid, but the route was too long… time was passing inexorably, and my hope in arriving at Arches NP before sunset was fading by the minute, I had to accept that we would reach there at night.

Along the route, Davide needed a loo, so we stopped and… "Miracle!": he found a population of *Sclerocactus wrightiae*, a very rare plant, which he had to document with a lot of photos. I was forgetting that I was there also to help him with his research: photography was important, but it was also very important to gather information about "succulent life" and its habitat.

In any case I still have my doubts that that find was not so accidental, but it doesn't matter…


Sclerocactus wrightiae

I have to admit that that stop was a very good thing, we also found a crested, flowered specimen of *Sclerocactus*. Driving on again, later at sunset I had the possibility to take many photos in a place where the sand was almost covered by blue flowers (*Astragalus* sp.), in that small corner of the southwestern desert.

Sclerocactus wrightiae

The arrival at Arches NP

Yucca harrimaniae

We had been in the car for 14 hours, with only a few, short stops. The darkness covered everything, only the stars accompanied us, occasionally we met a lonely car which annoyed our tired eyes with its head-lights, I don't remember how many times I felt like sleeping…

Davide was driving since too many hours without a rest and he really had to rest a bit, but…

STOP! Davide touched me, in order to wake me up, we were inside the park and just below the first rocky monoliths, he told me: "it's very good weather for night photography". I took the first shot at 10:00 PM, and after a sleepless night my last shot was taken at 7:00 AM, just after sunrise.

We had already spent the first week of our trip and we are suffering an excess of sleepless nights. In the middle of the morning, the cold night became a very warm day, without any clouds in the sky, a terrible drawback for a photographer.

Arches NP has a succulent symbol: *Sclerocactus parviflorus*. Big specimens were everywhere, all flowering that day. *Yucca harrimaniae* was also very common.

As I mentioned before, I considered myself to be a lucky photographer, since there I could observe and photograph a very rare phenomenon: the vaporization of the rain before it touch the ground.

The unique cloud arriving on the park was a storm cloud, which created that phenomenon and even a small rainbow, documented in my photos and in those by Davide, who was finally understanding the importance of the light to get a good shot, even with succulent plants.

Sclerocactus parviflorus

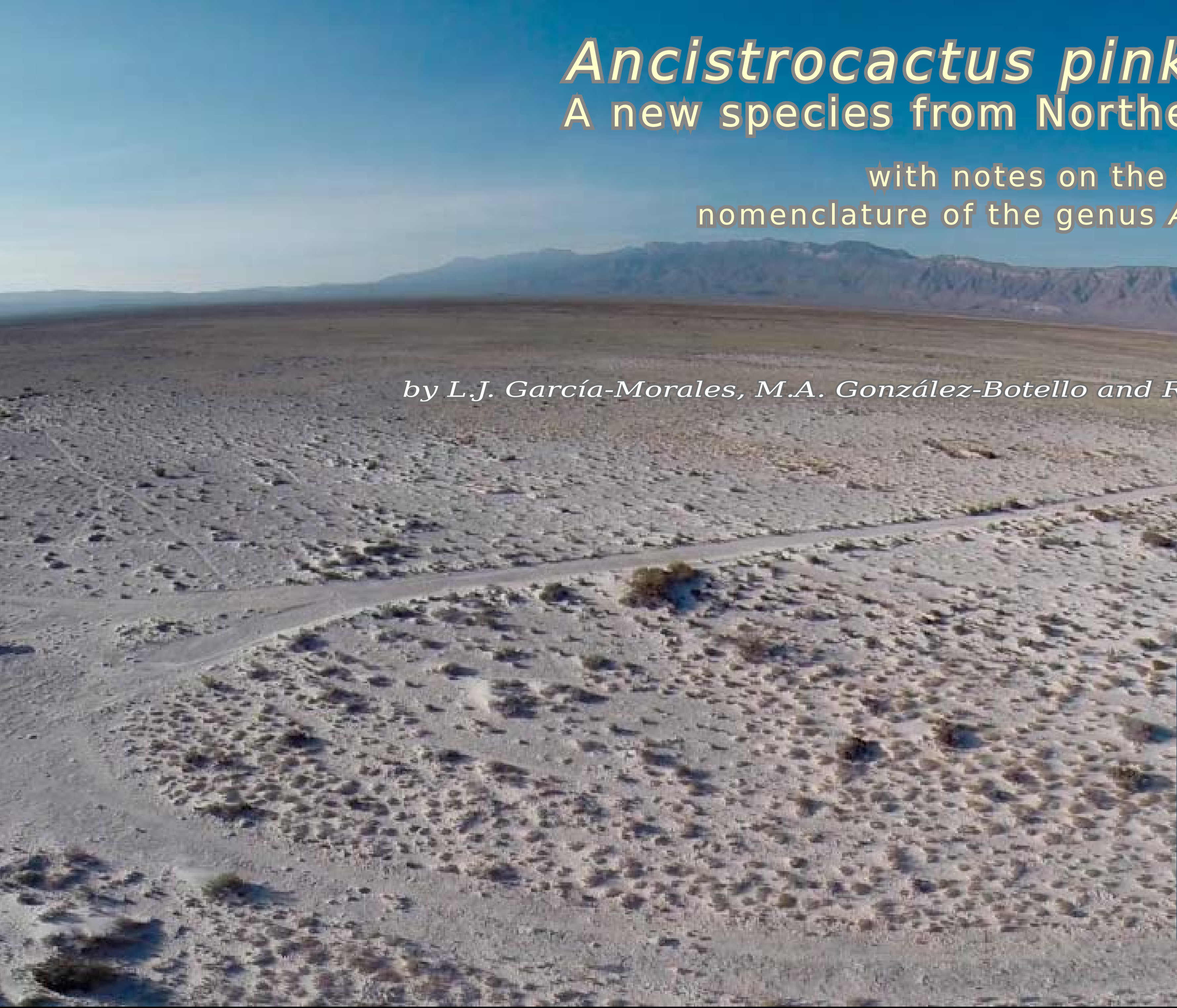
That's all for the first part of our trip, dedicated to 80% photography, and the rest being the search for plants.

Contact : http://www.viverelanatura.com

Ancistrocactus pinkavanus
A new species from Northern Mexico

with notes on the taxonomy and nomenclature of the genus *Ancistrocactus*

by L.J. García-Morales, M.A. González-Botello and R.H. González G.



Ancistrocactus pinkavanus
Fig. 12 - LGM

Abstract: A new species of *Ancistrocactus* (K.Schum.) Britton & Rose, endemic to the Cuatrociénegas Basin in Coahuila, is proposed as new to the flora of Mexico. We discuss the hypotheses and research presented by several authors which show that *Ancistrocactus* is a valid and independent genus from *Sclerocactus* Britton & Rose. A new key to the known species and subspecies of *Ancistrocactus* is presented.

Key words: Cacteae, *Ancistrocactus*, new species, endemic, taxonomy

Introduction

Over recent years, the genus *Ancistrocactus* (K.Schum.) Britton & Rose has suffered a number of changes in its nomenclature and taxonomy due to treatments by different authors. The genus *Ancistrocactus* was erected by N.L. Britton and J.N. Rose in 1923, taken from the same *Echinocactus* subgenus name proposed by K. Schumman earlier in 1898 (Doweld & Greuter, 2001). Recent DNA and phylogenetic studies have shown different results on its apparent relationships; being more accurate each time and which may in the present time validate the status of *Ancistrocactus* at a generic level for a small group of related species from North-eastern Mexico and Southern Texas in the USA.

Many morphological studies have demonstrated that within the Tribe *Cacteae* (Buxbaum classification) there exist several small genera among the whole, particularly all located in the deserts of Mexico and the USA. Among these, *Ancistrocactus* has been demonstrated by several authors to be distinct enough to deserve recognition at generic level; but some recent studies, particularly those focused on molecular techniques, have shown different results regarding their cladistics and phylogeny, as well as interesting results on other species considered belonging to *Ancistrocactus*.

The recent past

Bravo & Sánchez-Mejorada (1991) following Buxbaum´s classification, included *Glandulicactus* Backeb. as a subgenus of *Hamatocactus* Britton & Rose, and recognized *Ancistrocactus* as a separate genus, with 2 species: *A. scheeri* (Salm-Dyck) Britton & Rose and *A. tobushii* Marshall ex Backeb., maintaining *A. brevihamatus* Engelm., as a synonym of *A. scheeri.*

Doweld (2001) studied the genus *Ancistrocactus* s.l. from the perspective of the study of their seeds, noting its smaller flowers, indehiscent fruits and different seeds and testa surface, and also including *Glandulicactus* within it, but excluding both from *Sclerocactus* s.s. and separating both genera from the core of the "Ferocactus clade" of several DNA studies.

The incorporation in *Sclerocactus* sensu lato

For some authors: Anderson (2001), Guzmán *et al.* (2003), and Hunt *et al.* (2006) *Ancistrocactus* together with *Glandulicactus* were synonymized within the genus *Sclerocactus s.l.*, based on partial DNA and phylogenetic studies done for the genus *Sclerocactus* and *Toumeya* Britton & Rose by Porter *et al.* (2000).

After that, most of the recent phylogenetic and taxonomical studies carried out by researchers have taken this latter work as valid for the recent taxonomical and new nomenclatural arrangements, deprived of other morphological or structural analysis that involve all those genera. This later phylogenetic study does not actually demonstrate any direct relationship of *Sclerocactus* with *Ancistrocactus* and *Glandulicactus*, but indicates that *Sclerocactus* s.s. should be treated as a close sister node group within *Echinomastus* Britton & Rose, *Pediocactus* Britton & Rose and *Thelocactus* Britton & Rose.

A further DNA phylogeny study done by Butterworth *et al.* (2002) for the tribe *Cacteae* based on rpl16 Intron Sequence Variation showed that *Glandulicactus* is closely related to *Ferocactus* Britton & Rose, but meanwhile relates *Sclerocactus brevihamatus* (Engelm.) D.R.Hunt as a sister node in *Sclerocactus* s.s.

Ancistrocactus scheeri [Cuatrociénegas]


Fig. 6 - LGM


Ancistrocactus pinkavanus
Fig. 8 - LGM

Nyffeler & Eggli (2010) note that even with the molecular data obtained for *Sclerocactus*, the genus *Glandulicactus* and *Ancistrocactus* can be maintained as a segregate of independent genera following Lüthy (2007).

Heil & Porter (2003) and Zimmerman & Parfitt (2003a, 2003b) also note the distinctiveness of *Ancistrocactus* and *Glandulicactus* from *Sclerocactus s.s.*, founding their proposal on the known DNA data available, their unique morphological structures and the particular biology of these referred genera, splitting them all on the treatise of the Flora of North America.

New genetic evidence

For Hernández-Hernández & al. (2011) *Sclerocactus brevihamatus* is the next clade to diverge within the tribe *Cacteae* from *Echinocactus* Link & Otto and *Astrophytum* Lem. but only includes in the study *Sclerocactus brevihamatus* and some *Echinomastus* species (100 bML/95 bMP), although its earliest-diverging position from the remaining *Cacteae* members is poorly supported (58 bML). This clade includes solitary globose plants with low ribs.

A recent phylogenetic and ontogeny arrangement done by Vázquez-Sánchez & al. (2013) supports the relationships of *Sclerocactus scheeri* (Salm-Dyck) N.P.Taylor as a sister group of *Echinomastus* and as a basal node on the "Ferocactus clade", while relating *Glandulicactus* directly within the genus *Ferocactus*. An interesting result of this work relates the biogeographic origin for *Sclerocactus scheeri* superposing the biogeographic provinces of Morrone (2006), suggesting that the genus is limited in distribution and origin to the Tamaulipan Biotic Province and neighbouring areas of the Chihuahuan Desert, in Coahuila, Nuevo León and Tamaulipas States in Northeastern México, and South Texas State in the USA.

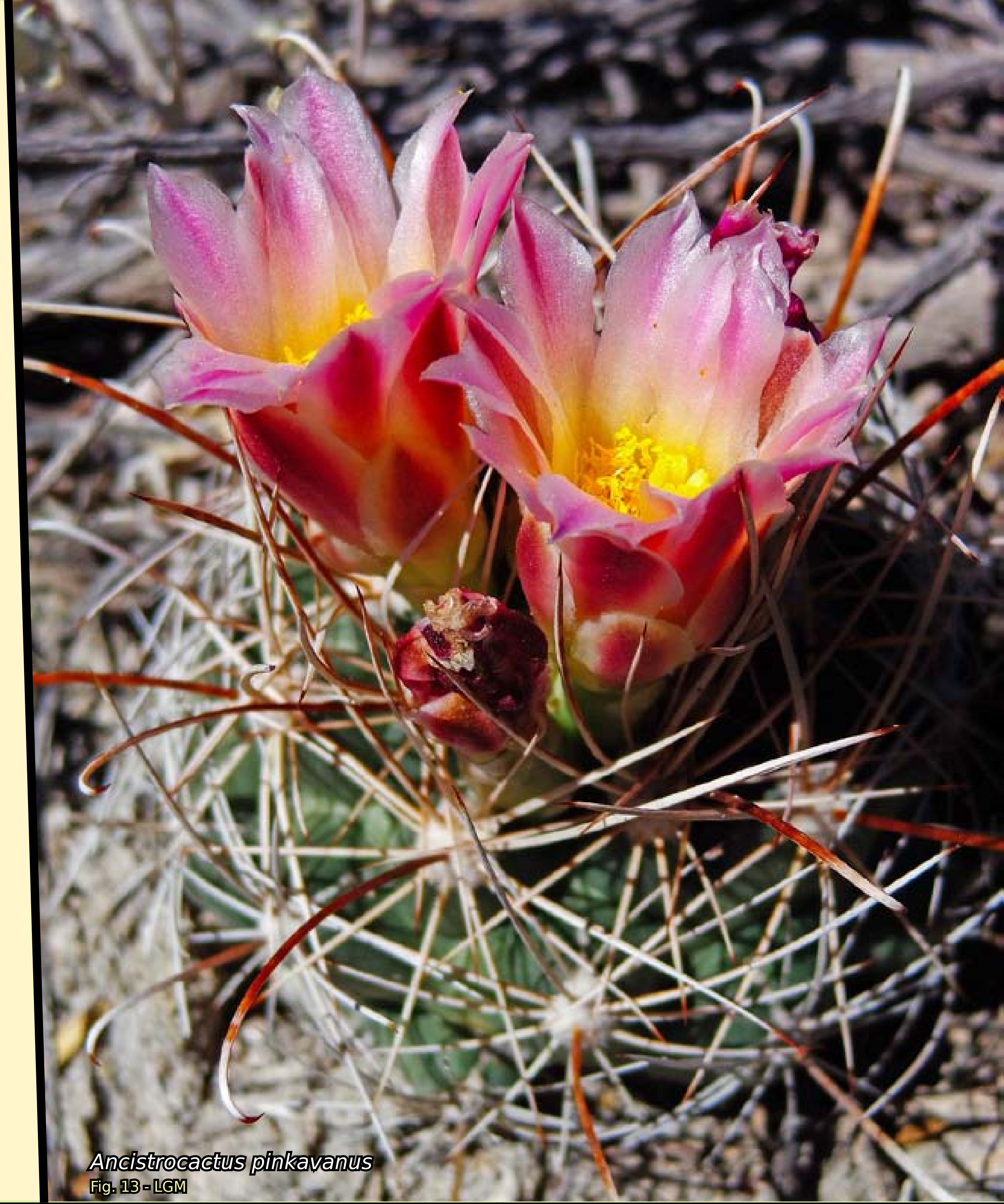
Nyffeler & Eggli (2010) state that the recent molecular phylogenetic investigations have multiple hypotheses about the relative relationships in the family *Cactaceae*, with several unexpected findings and others with a lot of suspicion, but in many other cases the previous knowledge was corroborated.

But as suggested by Gorelick (2002), DNA studies do not provide complete data for the whole classification of cactus groups and any phylogenetic study must be taken with caution as new genetic tools are continuously improving and also noting the lack or insufficient knowledge on DNA variations at generic, specific and infraspecific level is still present in many studies and phylogenetic analysis.

The renewed proposal of an independent genus *Ancistrocactus*

In the recent phylogenetic studies it is demonstrated that the *Sclerocactus* s.l. group is paraphyletic if we follow the classification proposals of Anderson (2001) and Hunt *et al.* (2006), which clearly show that *Glandulicactus* does not belong to *Ancistrocactus* s.s. or *Sclerocactus s.s.*, but is closely related to *Ferocactus,* and that *Ancistrocactus s.s.* is more closely related to *Thelocactus, Echinomastus* and *Echinocactus* than to *Sclerocactus*. Unfortunately Hernández-Hernández & al. (2011) and Vázquez-Sánchez & al. (2013) did not examine any representatives of *Sclerocactus* s.s. from its main distribution and diversification range located northwards in the deserts of Western United States to support their distribution and ontogeny hypotheses proposed for the "*Sclerocactus scheeri - S. brevihamatus* complex".

As noted previously by Donati (2013), we think *Ancistrocactus* is an independent and morphologically well supported group of species, confirmed by the taxonomical recognition of the genus from the basis of the phylogenetic and biogeographical hypotheses proposed by Porter & al. (2000), Butterworth & al. (2002), Hernández-Hernández & al. (2011) and Vázquez-Sánchez & al. (2013), but bearing in mind the need to broaden these studies with more species in future analysis.



Ancistrocactus pinkavanus

Fig. 13 - LGM

A new species of *Ancistrocactus* from the Cuatrociénegas Valley, Coahuila

Decades ago, Pinkava (1969) documented the presence of a species of *Ancistrocactus* from the Cuatrociénegas Basin, in Central Coahuila State, unfortunately without providing any formal publication or diagnosis of this interesting and endemic plant (Pinkava, 1981). More recently, several collectors have been announcing the discovery of this species as new, but also no one has actually provided any formal diagnosis on this long-known undescribed species.

Another recently described and poorly known taxon from the Trans-Pecos region in south Texas and probably north Coahuila is *A. brevihamatus* var. *pallidus* A.D.Zimmerman ex A.M.Powell (Powell & Weedin, 2004), which makes taxonomic recognition of the species of *Ancistrocactus* more difficult, as these plants are known to occur very scarcely in the area. They have some different characters from the typical *A. brevihamatus* subsp. *brevihamatus* according to the authors¸ mainly by their smaller solitary stems less than 6 cm diameter and height, pale white to cream flowers and smaller fruits around 1-2 cm long. Some authors have even suggested that the Cuatrociénegas plant and the South Texas plant are the same. It’s interesting to report that another subspecies of *Ancistrocactus brevihamatus* has been described: *A. brevihamatus* subsp. *tobuschii* (Marsh.) Taylor, which is endemic to a small area in south-central Texas.

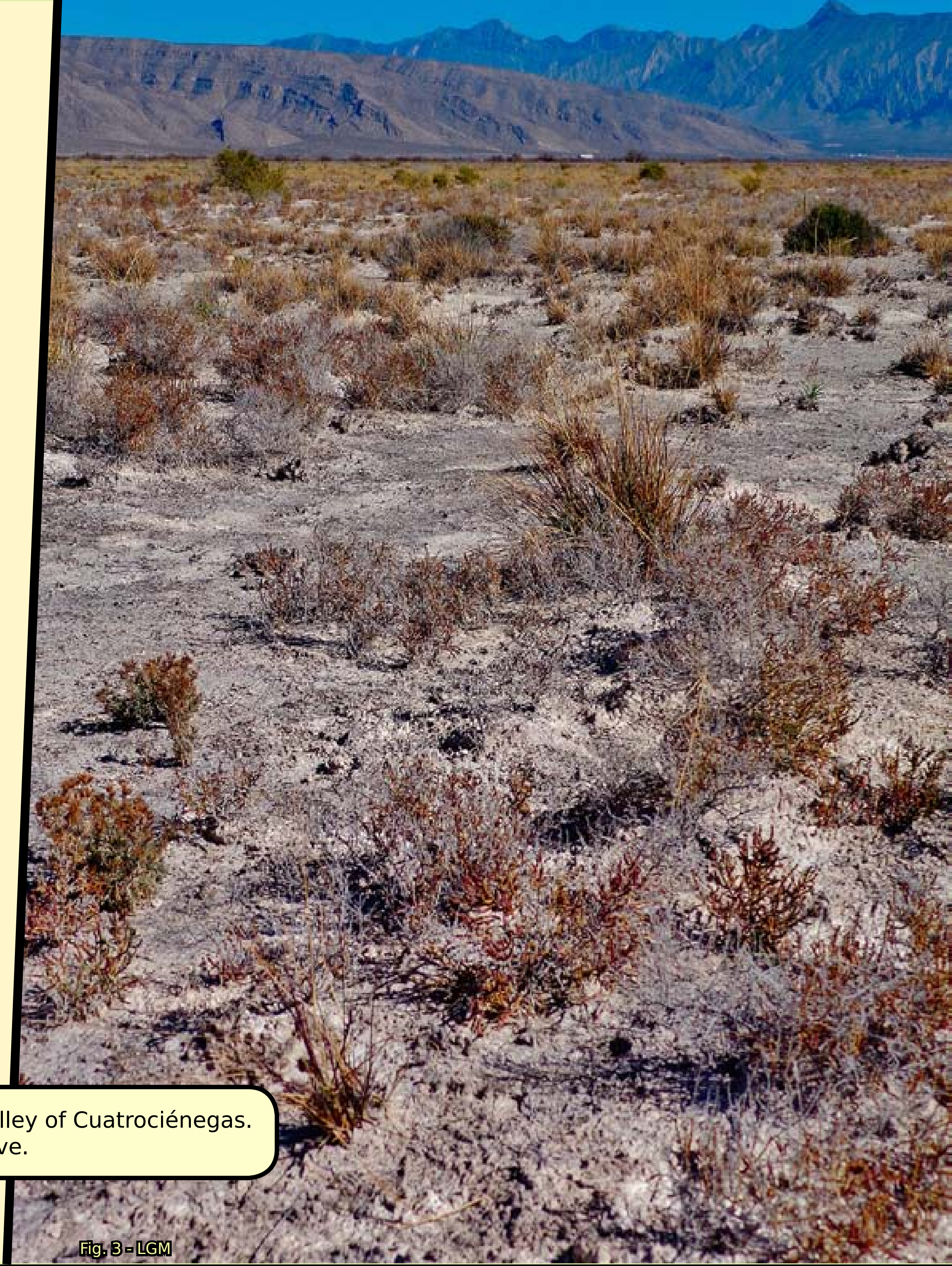
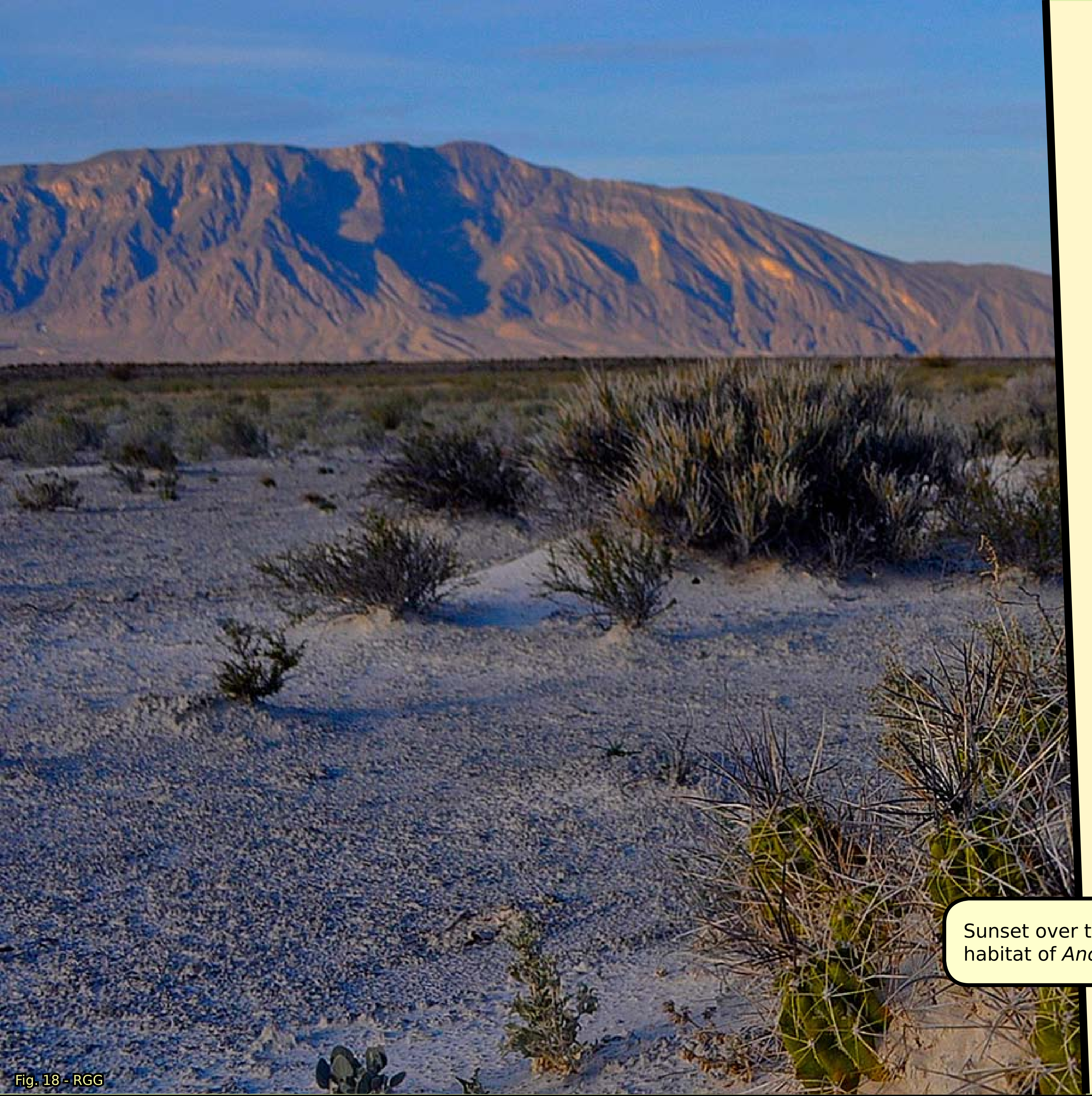


Fig. 3 - LGM

Habitat of *Ancistrocactus pinkavanus* in the Valley of Cuatrociénegas. Note the gypsum ground in which the plants live.



Sunset over the Valley of Cuatrociénegas, habitat of *Ancistrocactus pinkavanus*.

The lack of more accurate taxonomical and distribution data on *A. brevihamatus* var. *pallidus* and the dissimilarities with the description of both the Trans-Pecos and the observed characteristics of the Cuatrociénegas region plants suggests no close relationships between them so far, so we will include *A. brevihamatus* var. *pallidus* into the typical *A. brevihamatus* until more information appears on this taxon. Donati (2013) also commented on the possible confusion of *A. brevihamatus* var. *pallidus* with this new interesting endemic plant from the Cuatrociénegas region and remarked on the need for a formal description of the latter.

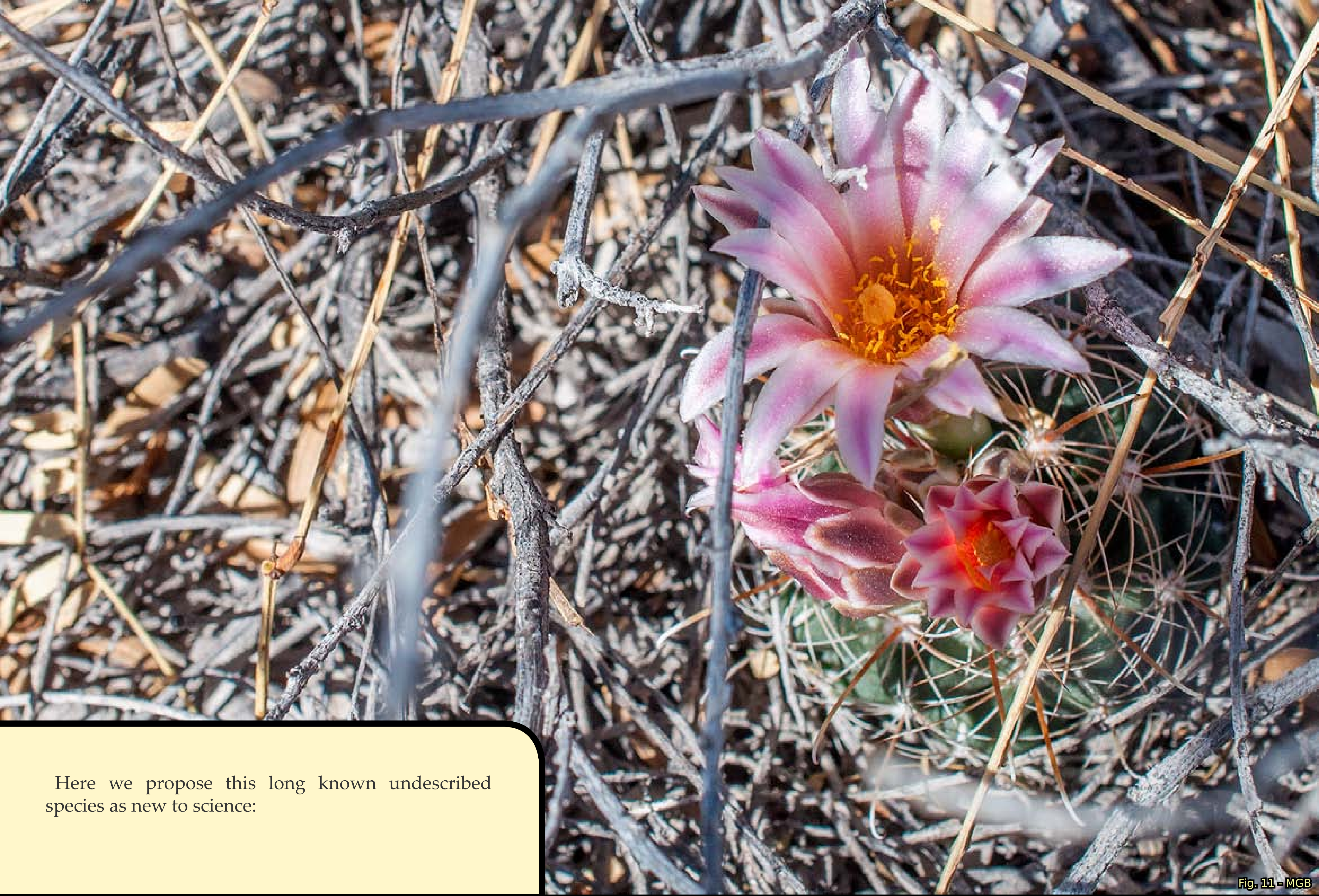
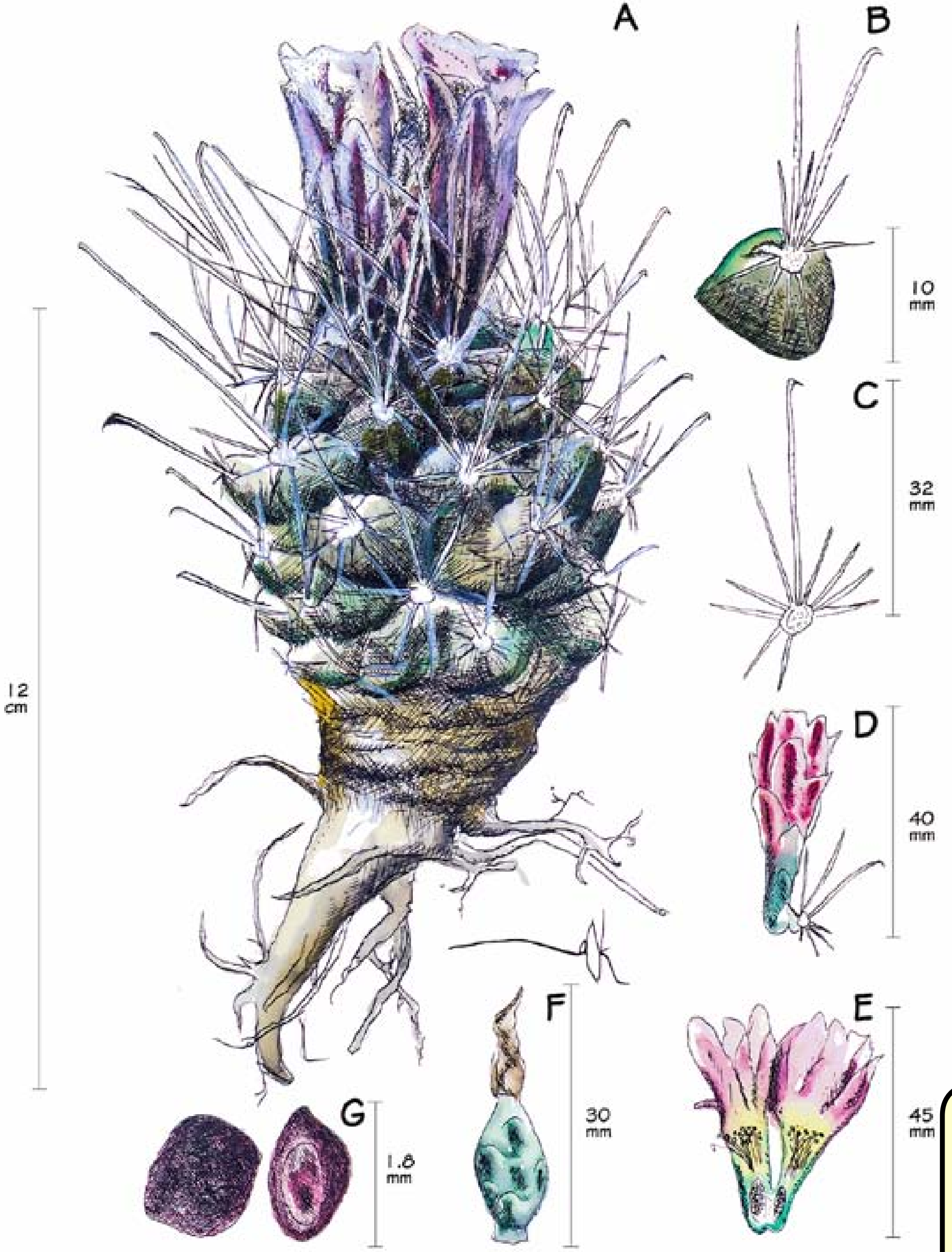


Fig. 11 - MGB

Here we propose this long known undescribed species as new to science:



Ancistrocactus pinkavanus García-Mor., González-Botello & González G., *species nova* (Figurae 1-16)

Ancistrocatus ; *tuberculis* glaucis, epidermide minute papilloso, sulco lanoso ; *radice* crasse tuberosa, flaccida, nec constricta ad collum ; *spinis radialibus* 8-10, acicularibus ; *spinis centralibus* 4, niveis ad fuscis, complanatis ; *spinis inferioribus* porrectis, uncinatis, rubris, *spinis su*perioribus rectis vel apice curvatis, apice rubris, acicularibus ; *floribus* amplis, roseis ad magenteis ; *fructibus* squamosis, viridibus ; *seminibus* diversiformibus, testa reticulati-areolata.

Affinis *Ancistrocacto brevihamato* est. Papilloso epidermide, paucioribus radialibus spinibus, collo nec constricto, colore florum, forma seminum, differt.

Habitat in septentrionale Mexicana regione, in gypsosis siccis arenosis planitiarum prope locum dictum Cuatrociénegas.

In honorem D.J. Pinkavae, qui floram illius loci studuit et prior illam plantam legit, dedicatus est.

Typus a nobis designatus : leg. Hinton et al., n° 29472, 2014-01-25 ; "Mexico: Coahuila State, North of Cuatrociénegas, gypsophilous grassland, 731 m"; Holotypus GBH (in Geo.B.Hintonii Herbario depositur) ; Isotypi : MEXU (Herbario Nacional de México), ITCV (Herbario del Instituto Tecnológico de Ciudad Victoria), TAMUX (Herbario del Museo de Historia Natural de Tamaulipas).

Specimina visa altera : leg D.J. Pinkava, E. Lehto & D. Keil, n° 5820, 1968-06-17 ; "Mexico: Coahuila State, Cuatrociénegas, tip of Sierra de San Marcos, Northeast-facing slope" ; Arizona State University Herbarium (ASU 0023489) — leg. D.J. Pinkava, n° 10447, 1973-03-20 ; "West of Cuatrociénegas, road to Ocampo, *Larrea-Yucca-Agave* flat" ; Arizona State University Herbarium (ASU 0023490).

Figure 1 : *Ancistrocactus pinkavanus* García-Mor., González-Botello & González G. sp. nov.
A. Habit of the plant – Tubercle, spines and areolar groove – C. Areole and spine – D. Attachment position of flower origin and tubercle – E. Flower in longitudinal section – F. Fruit – G. Seed. [Illustration by L. Rodríguez after Hinton et al. 29472]

Fig. 7 - LGM

Description

Plants: simple, not branching, 1.5-8 cm high, 1.5-7 cm wide, glaucous, gypsophyllous.

Roots: tuberous, carrot like, fleshy, soft, conspicuously geophytic on small plants, to 5-10 cm long and 3-6 cm wide, with few secondary soft roots distally, not separated from the stem by a constriction neck.

Tubercles: coalescent arranged in ribs, ribs usually spiralled, arranged in 8 and 11 spiral series; tubercles conical, rounded, 10-18 mm wide at base, 6-12 mm height, glaucous, with a conspicuous woolly groove that extends from the floriferous area of the areole to about half or more of the tubercle, widening at the end; with white wool about 1 mm long, epidermis with very small and abundant papillae, sometimes with a reddish gland.

Areoles: oval to near circular, 3-5 mm diameter, very woolly, wool white, about 2-3 mm long. *Radial spines* 8-10 (-11), 5-15 mm long, acicular, rigid, white, straight or slightly curved to the tubercle, the lateral ones longer, the inferior ones shorter, tips reddish brown. *Central spines* 4, rigid, the lower porrect, 12-32 mm long, flattened, hooked, white to brownish red colour, with a reddish tip; the rest in the apex of areole, erect, diverging, white, sometimes with the bases light brownish and the tips brown to reddish, flattened, straight or slightly curved to the apex of stem, 20-35 mm long.

Small flowering specimen of *A. pinkavanus*, less than 2 cm in diam., showing juvenile spination, (coin diameter around 25 mm).

Fig. 5 - LGM

Areolar groove with an extrafloral, nectariferous gland.

Fig. 16 - MGB

Flowers: emerging from the areolar groove, funnel-shaped to campanulate, 35-45 mm long and 25-40 mm wide, pink to magenta coloured, ovary green ovoid, with the walls thickened, not scaly, tube green, 10-15 mm long and 5-7 mm diameter, with 8-10 lunulated scales, 2-4 mm long and wide, green with the margins white, papery and slightly crenulated, outer segments of perianth 10, polymorphic, the ones at the base resembling the scales of the tube, oblanceolate to spathulate, 10-14 mm long and 4-6 mm wide at the middle, crenulated, greenish brown to magenta coloured, with the margins whitish and crenulated; the rest of external segments oblanceolate to lanceolate, with the tips rounded or bilobed, rarely acute, margins nearly entire, 15-25 mm long and 5-7 mm wide, pink coloured with a darker greenish brown to magenta midstripe. Internal segments of the perianth 8-10 oblanceolate to lanceolate, 25-30 mm long and 5-8 mm wide, with the tips acute or bifid whitish with a darker pink to magenta coloured midstripe, margins entire or slightly crenulated. Stamens 150-180, hyaline, pale green coloured, in several insertion series, 10-18 mm long, anthers oblong, 1.2-1.5 mm long and 0.5 mm diameter, yellow. Style pale yellow to pale green, 10-14 mm long; stigma lobes 6-8, pale yellow, 3 mm long and 1 mm wide, sulcate on the outer side.

Fruit: green, sometimes with reddish tinge, soft, fleshy, 15-20 mm long and 7-12 mm wide, scaly, scales greenish-white, lunulate, papery, 2-4 mm diameter.

Seeds: distinctly half rounded or helmet-like form, 1.8-2.2 mm diameter, keeled on the outer margins, glossy dark brown to black, testa with cells reticulate to areolate, finelly papillate and flattened, becoming smaller into the hylum-micropylar area.

Etymology: This new species is dedicated in honour of Donald J. Pinkava; North American botanist, specialist in *Opuntia* and pioneer on the knowledge of the flora and vegetation of the Cuatrociéngas region where the plant was found.

Typical stamens, antheres and stigma lobes.

Fig. 14 - LGM

Recognition and phenology

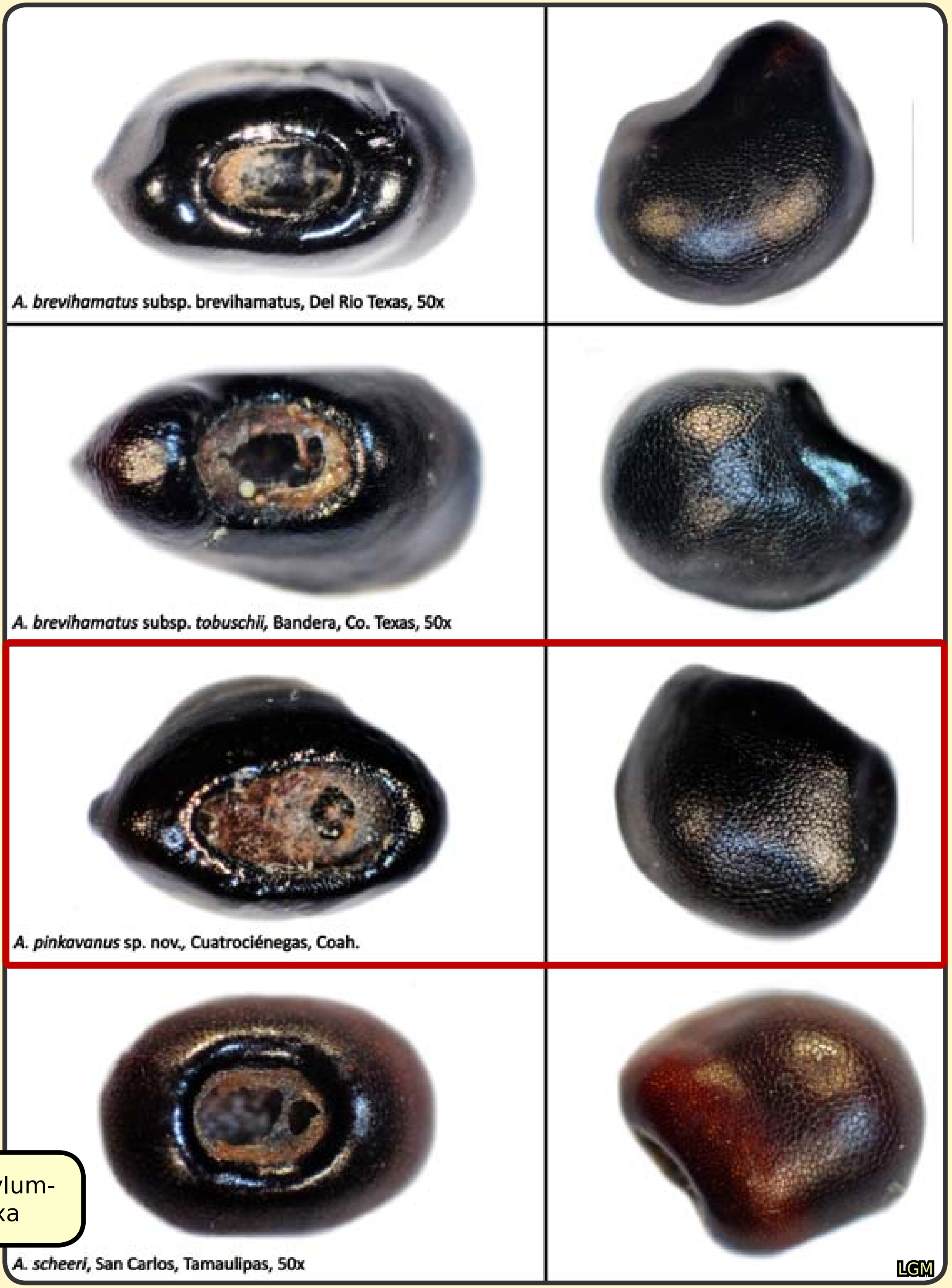
This new species has unique characters among *Ancistrocactus s.s.*, distinguished from the rest of the taxa by the gypsophilous habit, the glaucous papillose epidermis, the small number account of radial spines, the fleshy tuberous root system not separated from the stem by a constricted neck, flowering juvenile plants, the pink to magenta flowers and by the unique shaped seeds among the rest of close related species. All species seems to flower in the same time period, at the end of the winter season and beginning of spring, between the months of January and April. The flowers of *Ancistrocactus pinkavanus* appear in late January to early March, and the fruits mature in 1-2 months around.

Small plants just above 1.5 cm diameter have the capability to produce flowers and fruits that improve the chance of reproduction at an early stage; the flowers last for a short time and close immediately after pollination. We did not observe any pollinators on the flowers of *Ancistrocactus pinkavanus* when we surveyed the area in the middle of February and when most of the plants were flowering at same time.

Ancistrocactus pinkavanus is not known to hybridise with the other species that live in the Cuatrociénegas valley, or in the neighbourhood: *A. scheeri* lives very close to *A. pinkavanus*, on flat, limestone gravelly areas to the north, east and west of the surrounding valley. They show a quite distinct ecology, as the soil is an indicator of the distribution of these species: *A. scheeri* on gravelly soil, *A. pinkavanus* on gypsum flats.

A. brevihamatus is known to live near Monclova, some 50 km to the north-east of the Cuatrociénegas valley. The taxonomical characters of the populations observed are very constant along its distribution range and habitat. Also in this case, the ecology is quite distinct, because *A. brevihamatus* grows on gravelly soil.

There are some differences observed between the taxa of *Ancistrocactus* as in follows in the **Table 1**.


A. brevihamatus subsp. brevihamatus, Del Rio Texas, 50x

A. brevihamatus subsp. *tobuschii*, Bandera, Co. Texas, 50x

A. pinkavanus sp. nov., Cuatrociénegas, Coah.

A. scheeri, San Carlos, Tamaulipas, 50x

Table 1: Comparison between the seed shape and hylum-micropylar area of the different *Ancistrocactus* s.s. taxa

Ancistrocactus pinkavanus
Fig. 15 - LGM

Ancistrocactus brevihamatus [Monclova]

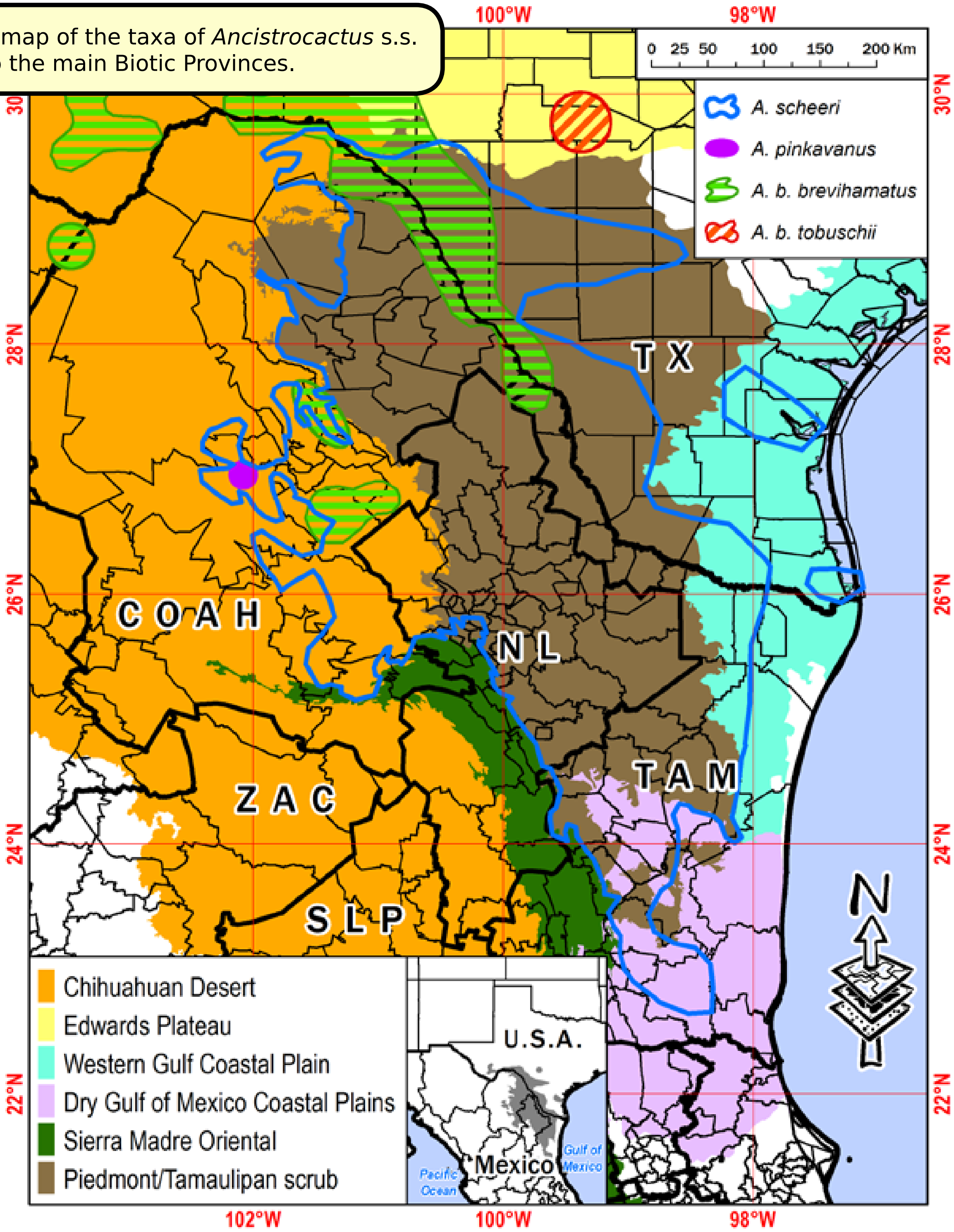
Distribution and conservation

This new species is an endemic of the Cuatrociénegas Basin in Central Coahuila State, Mexico, where it lives exclusively on gypsophile grasslands between 700 to 900 m above sea level; it lives among many species of grasses, with *Bouteloua* spp. and *Sporobolus* spp. as dominant species and many other herb-plants like *Atriplex* spp., *Cryptantha* sp., *Nama* sp., *Dyssodia* sp., *Nerisyrenia* spp., *Flaveria* sp., *Machaeranthera* spp., and several cactus species as *Coryphantha macromeris, Coryphantha poselgeriana, Echinocactus texensis, Echinocereus enneacanthus, Escobaria vivipara, Opuntia engelmannii* subsp. *engelmannii, O. phaeacantha* and *O. rufida*.

This species can be considered as rare among the plants within the Cuatrociénegas valley, since the plants live scattered along most of the gypsophile grasslands, with a low abundance in the area. A short survey on a 40000 sq. meter plot showed the presence of about 40 flowering plants, no small seedlings were seen in the area. However, the plants of *Ancistrocactus pinkavanus* have been documented as being geophytic and mimetic within grasses or nearly buried within the soil level (Donati, 2013), so many adult plants and seedlings may have been overlooked within the surveyed area.

This species is non-threatened directly by human activities or major developments on the area, as it lives inside the Natural Protected Area of Cuatrociénegas since 1994, which ensures the protection of the species within the valley. A threat observed in some areas is the presence of cattle inside the valley that may affect some populations of *Ancistrocactus pinkavanus*. The habitat of this species is not suitable for any agriculture or other infrastructure development.

Distribution map of the taxa of *Ancistrocactus* s.s. according to the main Biotic Provinces.



Specimen with pinkish flower, growing in a fully exposed place.

Fig. 10 - MGB

Key to the taxa belonging to *Ancistrocactus* s.s.

(Adapted from Doweld, 2001; Heil & Porter, 2003; Hunt, 2006., Zimmerman & Parfitt, 2003)

1. Tubercles without glands on stem areoles. Central spine(s) generally flattened, thin, sometimes papery or, if central spine(s) is absent, ~~then~~ radial spines usually strongly flattened. Fruits dehiscent along 2-4 irregular, short vertical slits above base, or through basal abscission pore, green, yellowish or reddish, glabrous or with some scales, dry. Distribution: West United States in Arizona, California, Utah, Nevada, New Mexico, Colorado and West Texas .... ***Sclerocactus*** s.s.

1´. Tubercles with glands present in adaxial extension of mature stem areoles. Adaxial upper central spines distinctly flattened, abaxial central spines porrect, hooked, radial spines acicular. Fruits green to reddish, fleshy, with numerous scales, not dehiscent by a basal pore or slit. Distribution: Tamaulipan thornscrub and Chihuahuan Desert regions, Northeastern México and South Texas....... ***Ancistrocactus*** s.s. ….**2**

2. Stems single. Tubercles not arranged in conspicuous ribs. Radial spines 7-18, acicular yellowish, central spines 1-5, mainly 3, abaxial one hooked. Roots short, with a short conic taproot or fibrous roots, without constriction between stem and roots..**3**

2´. Stems single or occasionally branching. Tubercles arranged or not in ribs. Radial spines 8-28, acicular, with or without darker coloured tips, central spines 1-3, the principal hooked. Roots fleshy, tuber-like taproot, separated or not from the stem by a fragile constriction **4**

3. Radial spines 7-18, spines yellowish, acicular, central spines sometimes scarcely rigid or even fairly papyraceous. Distribution: South Texas, North Tamaulipas, North Nuevo León and North-Central Coahuila .... ***Ancistrocactus brevihamatus*** subsp. ***brevihamatus***

3´. Radial spines 7-9, spines yellowish, finely hairy, yellow with red tips. Distribution: Bandera County, Texas..…
.... ***Ancistrocactus brevihamatus*** subsp. ***tobuschii***

4. Tubercles arranged in conspicuous ribs. Roots fleshy, tuber-like taproot or sometimes very thin taproot or fibrous, with secondary roots bulbous, always separated from the stem by a fragile constriction. Radial spines 13-28, central spines 1-4, the abaxial one porrect and hooked. Distribution: Texas, Tamaulipas, Nuevo León and Coahuila..***Ancistrocactus scheeri***

4´. Stems with tubercles loosely arranged in ribs. Roots fleshy, tuber-like taproot not separated from the stem by a constriction, secondary roots fleshy, soft. Radial spines 8-10, central spines 1-4, the abaxial one porrect and hooked. Plants able to flower at juvenile state. Distribution: Cuatrociénegas Valley, Coahuila..***Ancistrocactus pinkavanus*** sp. nov.

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Fig. 2 - LGM

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(Title page: drone photo: RGG, plant: MGB)

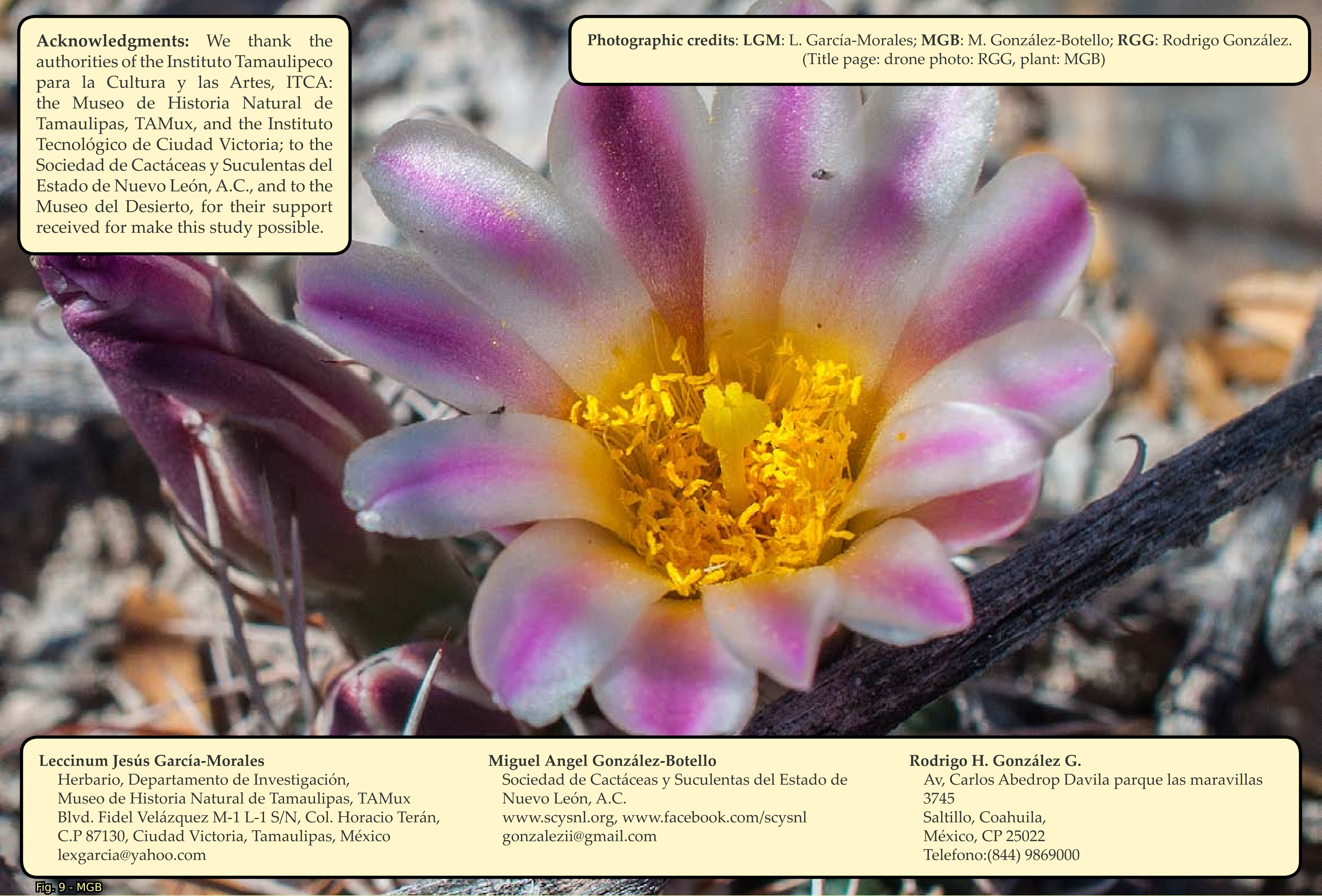

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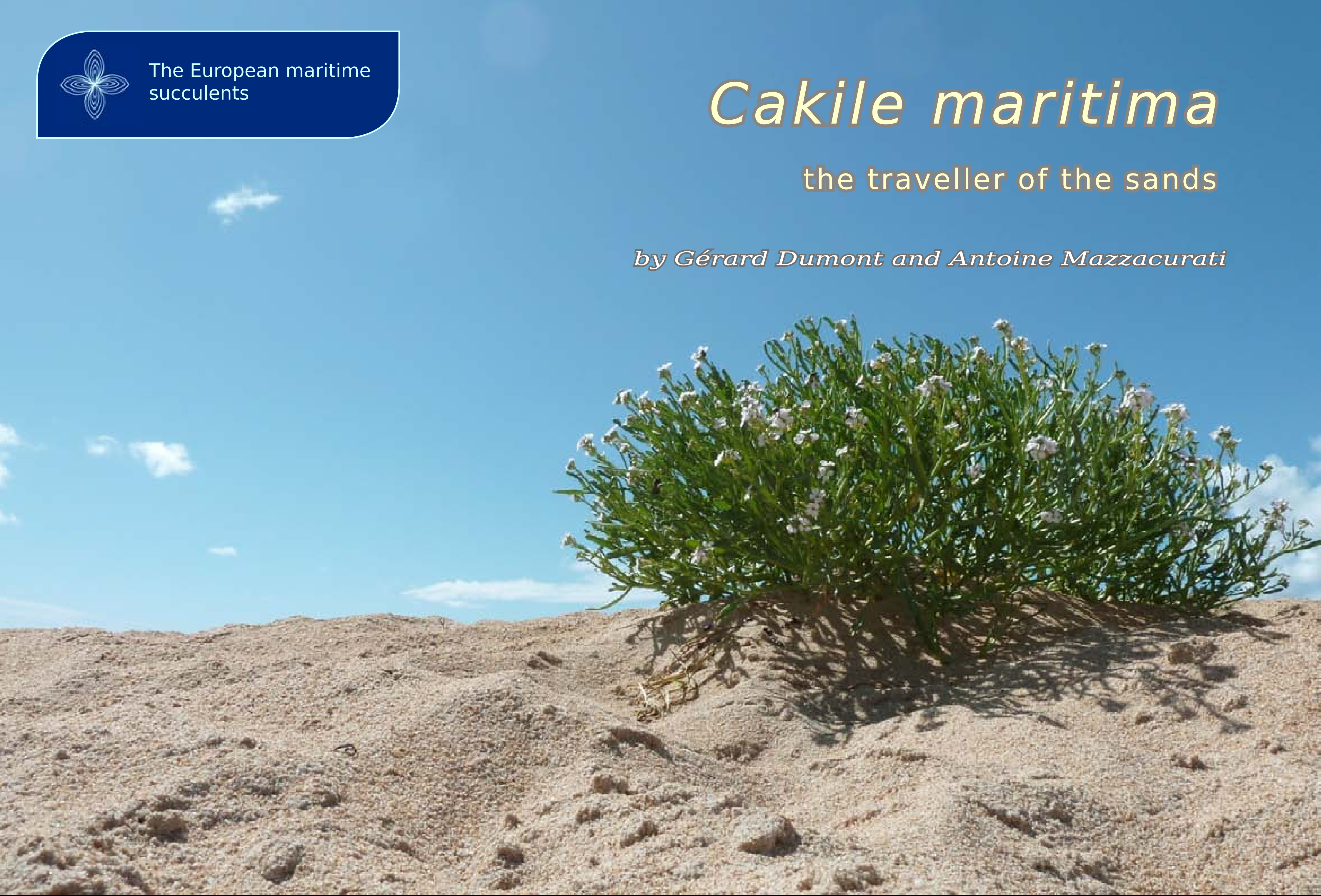
Fig. 9 - MGB

The European maritime
succulents

Cakile maritima

the traveller of the sands

by Gérard Dumont and Antoine Mazzacurati



In the previous issue of *Acta Succulenta*, we presented a characteristic maritime succulent from the upper beaches, *Honckenya peploides* (L.) Ehrh., the 'Sea Sandwort'. That presentation led us to briefly mention another succulent plant that accompanies it, almost always on European beaches: *Cakile maritima* Scop., the 'Searocket'.

As promised, today we return to the latter in more detail.

Ecology

Cakile maritima is one of the few plants that participate in the plant communities of the upper beaches of the Atlantic temperate zones of the Northern Hemisphere, in the company of *Honckenya peploides*, *Atriplex* spp. (*A. laciniata* L. mainly) and *Salsola kali* L. It should be noted that all these plants are succulent except the atriplexes (*Atriplex* spp.). A few other plants sometimes accompany them (or replace them southwards), but either these are less strictly dependent on the upper beach and make only inroads into it, or they prefer calmer and sheltered conditions (estuaries, etc.).

On the Mediterranean coast, *Cakile maritima* is often associated with *Eryngium maritimum* L. and *Xanthium* spp., facing the sea as the first vegetation line. These Mediterranean communities have, like these of oceanic upper beaches, a pioneering behaviour but form a protective vegetation line that is stabler and less subject to annual fluctuations than in oceanic areas.

We have already described in detail(1), about *Honckenya peploides* and the features of the very special and very hostile environment that the upper beach is for a higher plant. Thus we refer the reader to that article, because everything that has been said about *Honckenya peploides* also applies to *Cakile maritima*.

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(1) Dumont G. & Mazzacurati A. (2013), Honckenya peploides, a succulent at the beach, in *Acta Succulenta* 1(2): 159-196.

From the upper beach to the grey dune

In the upper beach environment, *Cakile maritima* behaves strictly as an annual, while further back in the white dune or in the grey dune, it survives the winter and behaves as a short-lived perennial[2] (2-3 years maximum). It should be noted that when this plant lives for two years (often the case) it is not a biennial in the usual sense of the word but is a short-lived perennial. Actually a biennial plant grows vegetatively the first year and flowers the second, and then dies after fruiting, while *Cakile maritima* flowers profusely the first year, survives this flowering and blooms again the following year and then dies, or survives the winter again to bloom for a third year.

It would be a mistake to conclude that the conditions of the upper beach are so difficult for it that its survival is prematurely shortened there. Indeed, it is most often on the upper beaches that the finest individuals of this plant are found! In fact, it is mainly the vigour it shows there, combined with abundant fruiting, which exhausts it totally at end of the season. It can be noted that individuals growing on the beach usually die en masse *before* the worst storms of autumn, while individuals further back continue to live while reducing their branches and blooms until winter.

---

[2] Most papers in the literature or the Web mention this plant as annual, mistaking its actual life cycle (the real cycle according to the environmental context) and its potential natural cycle. *Cakile maritima* adopts a pure annual cycle only on upper beach, elsewhere it tends to be a short-lived perennial.

Cakile maritima has a much wider ecological latitude than *Honckenya peploides* (cf. l.c.). The latter fails to permanently settle elsewhere than the upper beach and dune foot or pebble-bar foot, while *Cakile maritima* is not uncommon in the white dune, but it is never dominant there or even truly abundant, never more so than on upper beach where it can form large populations, monospecific in places, fed by the deposits of the high tide mark because, like other plants of the upper beach, it is halonitrophilous. One can even find it here and there lost in the grey dune; it is rare but its growth there is quite normal as long as the soil is rich enough, hence mainly in disturbed areas rich in organic deposits. It can also sometimes be found in the salt marshes.

Cakile maritima growing in the middle of the white dune among *Ammophila arenaria*.

In addition to the upper beach, *Cakile maritima* particularly enjoys a rather special and temporary habitat that is formed by the deep and narrow transverse grooves created in winter in the white dune by the wind and the sea. It colonizes them quickly in the spring and its vigorous tufts stop and accumulate the sand, accelerating the "healing" of the dune. As such, it plays an important role in dune dynamics.

In fact, unlike *Honckenia peploides*, its strong preference for the upper beach seems to be more to do with a *competitive* nature rather than a physiological one: *Cakile maritima* has developed all the required capacities to colonize this hostile biotope in which it encounters little competition, then it thrives abundantly there. Further back, the conditions also suit it but it is less efficient(3) because of competition by other plants which, unlike it, are unable to colonize the upper beach and hence are confined to the dune and the back-dune.

It's the end of autumn. All the *Cakile maritima* of the upper beach are dead. Note the micro-dune created by the presence of the plant.

---

3 It seems that the competition takes place mainly for the young seedlings of *Cakile maritima*. These are very light-demanding and require an open environment to develop. They are very susceptible to competition from neighbouring plants and disappear quickly, but the few survivors, once past the sensitive stage of the young seedling, then have normal growth.

The conquering spirit

Just as for the two other maritime succulents that we presented previously here⁽⁴⁾, the remote dissemination of *Cakile maritima* seeds is performed by the sea (thalassochory). The "seeds" (fruit fragments in reality, cf. infra) are ideally adapted to this mode of dissemination: they float and the sea water inhibits germination until they are deposited on a beach where the desalination by rain will stop their dormancy. Their survival in seawater is particularly long: seeds of *Cakile maritima* can float at sea for a year⁽⁵⁾ whilst keeping intact their germination potential. Needless to say, the path during this time by the winds and currents can be important!

Cakile maritima has another very special ecological adaptation. It has been shown⁽⁶⁾ that seed germination was inhibited not only by sea water but also by *light*, which is a reverse phenomenon to that of most other plants: usually light stimulates germination and seeds buried too deeply remain dormant until their exhumation. Instead, seeds of *Cakile maritima* need to be buried under 5 to 10 cm below the surface in order to germinate properly. The adaptive advantage is immediately understandable for a plant germinating in such a mobile and hostile environment as the sand of the upper beach. Consequently, when they emerge, the seedlings are already firmly implanted in the substrate, especially as their main taproot grows quickly to anchor the plant as deeply as possible. For seeds deposited on the surface or too near it, the inhibition of germination by light allows them to wait to be buried by deposits brought by the wind and the sea before germinating. This adaptive inhibition therefore considerably reduces the risk that young seedlings of *Cakile maritima* are swept by winds and tides before being sufficiently anchored in the substrate.

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4 Dumont G. & Mazzacurati A. (2013), *Crithmum maritimum*, the succulent of storms, in *Acta Succulenta* 1(1): 23-51. ; *Honckenya peploides*, a succulent at the beach, *l.c.* 1(2): 159-196.

5 Gandour M. & al. (2008), Understanding the population genetic structure of coastal species (Cakile maritima): seed dispersal and the role of sea currents in determining population structure, in Genetics Research 90(2): 167-178.

6 Barbour MG. (1970), Germination and Early Growth of the Strand Plant Cakile maritima, in *Bulletin of the Torrey Botanical Club* 97(1): 13-22.

At the cotyledon stage, the plant is already obviously succulent.

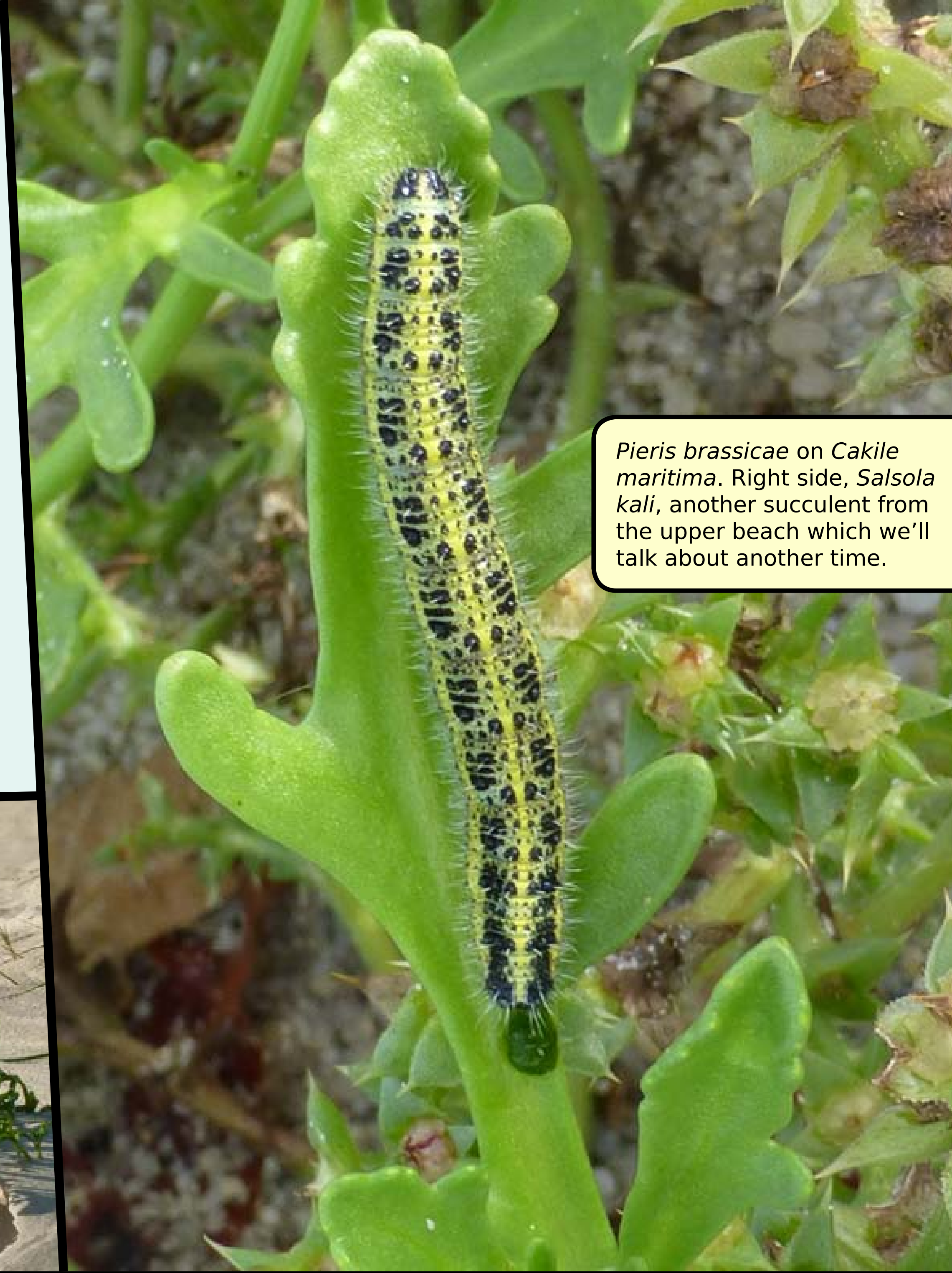
Cakile maritima has a very widespread period of germination *in situ*; it is highest in the spring, but one sees many young seedlings until the end of summer, which allows the plant to easily replenish its populations even if the earlier seedlings were destroyed by late storms.

All this leads to a great dynamism and a strong reactivity of the populations of *Cakile maritima*, in one way or another. Thus, there are some "Summers of Cakile" during which the plant pullulates and some others where it is much less abundant, but a relative scarcity in summer is often followed by a significant rebound in populations at the end of the season due to the rapid growth of the plant after a late germination.

Abundant germination of *Cakile maritima* on the upper beach in the spring.

The reasons for population fluctuations of *Cakile maritima* from one year to another are not always obvious. The weather certainly has a great influence but it is not the only one. Among other factors, pathogens undoubtedly have an effect, among them the caterpillar of the Large White (Cabbage White, *Pieris brassicae*) during the summer and early fall, and a fungus visually similar to rust (*Albugo candida*?) that attacks seedlings during some cold and wet springs, but for the latter, it is unclear whether the presence of this pathogen is the cause of the poor physiological state of the host plant or the consequence of the state itself.

Like all upper beach plants, *Cakile maritima* is a pioneer plant with a strong colonizing ability. One example among many: a new volcanic island, Surtsey, appeared in 1963 off the coast of Iceland and access was forbidden to observe the process of its biological colonization. The first higher plant appeared there in 1965, it was *Cakile maritima*! Even better: a new sandy island appeared in 2009 in the estuary of the Gironde (France), and which was the first plant to establish its foothold on the island? *Cakile maritima* again, and that was only four months after the emergence of the island!



Pieris brassicae on *Cakile maritima*. Right side, *Salsola kali*, another succulent from the upper beach which we'll talk about another time.

A facultative CAM plant

The CAM(7) photosynthesis pathway has rarely been demonstrated in the European maritime succulents. Some may nevertheless use it as a facultative and accessory way, depending on environmental constraints. This is the case of *Cakile maritima* which mainly uses the classical path C3 – more effective than CAM – in conditions where the salinity is low or moderate but seems to be able to partially switch to CAM when salinity increases(8). The physiological value of CAM in these conditions is the nocturnal accumulation of organic acids that facilitates the maintenance of the intracellular ionic balance in case of accumulation of cations (Na). In the case of *Cakile maritima* the CAM metabolism, however, remains as accessory because it only uses the respiratory CO_2 and not the CO_2 from the atmosphere.

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7 **C**rassulacean **A**cid **M**etabolism: metabolic pathway allowing photosynthesis with close stomata thanks to prior storing of CO_2 as organic acids.

8 Diallo N. (1980) ; Adaptation du métabolisme à la présence de NaCl, cas du *Cakile maritima* et du *Kalanchoe blossfeldiana*, Thèse Paris-6.

Quite a winged little world frequents the scented and nectariferous flowers of *Cakile maritima*.

Description

Plant: Annual or short-lived perennial, fast growing and early flowering; ramose with more or less prostrate fleshy stems forming a loose dome, much wider than high, 30-50 cm high on average in summer.

Racine: main root as a single long taproot, plunging deeply in the ground.

Leaves: alternate, glabrous, fleshy, glossy; blade deeply sinuate and unevenly and imperfectly symmetrically lobed; leaf margins are slightly thickened and slightly curved inwards; the shape of the blade is very variable both in the same individual and according to the population.

Flower: hermaphrodite, typical of the *Brassicaceae*: 4 sepals, 4 petals, tetradynamous androecium(9); diameter between 0.5 and 1 cm, pedicellate; petal colour varies from pure white to purplish pink and varies in a single population, preponderance of one or the other colour in the population also varies according to the population; nectariferous and pleasantly scented flower attracting many insects.

Fruit: siliqua, spontaneously breakable as two monosperm indehiscent segments of unequal size (heteromericarpy), the distal segment is spontaneously caducous while the proximal segment is persistent. [This very characteristic fruit is treated in detail below.]

Possible confusion

Cakile maritima is difficult to confuse with anything else *in situ*, other European maritime crucifers (*Matthiola* spp. *Cochleria* spp. *Crambe*, etc.) having a very different appearance. It could most easily be confused with *Crambe maritima* L., because of its fairly close white flowers, but it has very large curly leaves, grows mainly on pebble bars, more rarely on coarse sand, and is much less common than *Cakile maritima*, especially south of the Iroise Sea.

In cultivation, *Cakile maritima* may superficially resemble some other cruciferous crops (the *Brassicaceae* family is large and includes many crops, agricultural, vegetable and ornamental ones), especially by the appearance of its flowers which are very constant in this family, but the neat succulence of its leaves and the appearance of its fruits immediately separates it from its cousins.

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(9) The tetradynamous androecium is an androecium made of six stamens, 4 long and 2 short. This kind of androecium is typical of the *Brassicaceae*.

Like here, being regularly and almost completely buried in the sand carried by the wind is not a problem for this plant; on the contrary, its growth will be stimulated by it.

Its fruit, a marvel of plant intelligence

Remember that evolution has no aim, it only has consequences, and vegetable intelligence obviously does not exist, in the usual sense of reasoning ability. Nevertheless, the results of evolution and natural selection sometimes give an impression that it does!

The fruit of *Cakile maritima* is a good example of that. It is not very big and looks rather banal: its shape is vaguely reminiscent of a small greenish, then straw-coloured, *Coca-Cola* bottle. It is not very beautiful and has certainly nothing that catches the eye at first. However it's an extremely evolved and ingenious organ which is one of the keys to the ecological success of this plant.

As in all *Brassicaeae*, this fruit is a siliqua, i.e. a dry bivalve fruit consistings of two carpels united by their placental margins with the formation of a false-septum between them.

From this plan common to the whole family, *Cakile maritima* has perfected the system. First, its fruit became indehiscent: it can no longer split longitudinally to release the seeds; in compensation, it became spontaneously breakable transversely between the seeds and the quantity of them was reduced to two per fruit. These two sections being one-seeded and indehiscent, they therefore behaved functionally like seeds but well-protected seeds from external attacks by an additional wall contiguous to their own wall. Although anatomically different, the result is functionally close to an achene as in *Crithmum maritimum*(10). This extra protection is useful for a seed whose the fate is to be violently tossed about by water and sand.

But *Cakile maritima* did not stop there. Dispersing its seeds as far as possible to conquer new territories, is all well and good, but when you are an annual plant (or behave as such) being sure that no one will overtake your place the following year is essential. Go and stay: how to resolve this paradox? *Cakile maritima* has found the solution: from the two segments of fruit only the distal segment is caducous and will be dispersed, while the proximal brother will remain securely attached to the mother-plant even after her death. It will be therefore able to germinate on-the-spot and take over from the mother-plant because there is no question of such a beautiful property with sea views leaving the family!

For the brother, the adventurer, as it is intended to be dispersed by the wind and waves, his mother makes a beautiful corky buoy (the wall of the distal segment) before leaving that will allow it to float up as it is deposited on a beach in the middle of a high tide deposit to found a new family in turn. The proximal brother being destined to remain at home, did not need this luxury buoy, so the mother-plant made cheaper clothing, a small but robust floating vest (if it comes off and wants to follow the path of its brother), but the large buoy will be reserved for the travelling brother.

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(10) Dumont G. & Mazzacurati A. (2013), Crithmum maritimum, the succulent of the storm, in *Acta Succulenta* 1(1): 23-51.

Fruiting of *Cakile maritima* is usually very abundant!

To go on a trip, everyone knows that it is prudent to take provisions with you, and *Cakile maritima* thought of that too; the seed of the traveller-son will be bigger and richer in oily reserves than the one kept lovingly at home. If fate decrees that the adventurous son finishes his long journey too deeply buried in the sand of the foreshore, he will be still able to germinate and emerge in the sun because he has all the necessary reserves for this.

Keeping some of the brood at home would be useless if any passing bird can feast on it. For this, mom-Cakile also found an answer: she dresses her children in camouflage. Indeed, the proximal segment of the fruit looks just like a single stalk, just slightly thicker, and no bird would think it hides an oily and appetizing seed!

But *Cakile maritima* knows also how to be a pragmatic mother, who does not begrudge practicing infanticide if necessary: children are expensive to feed and as it would be foolish to divide the inheritance with too many children remaining on-the-spot, she euthanizes in cold blood some of the seeds of the lower segments before their birth(11), but never those of the upper segments, knowing the dangers that their adventurous and uncertain life has been reserved for them.

Finally, we are not as sure as before that plant intelligence(12) doesn't exist...

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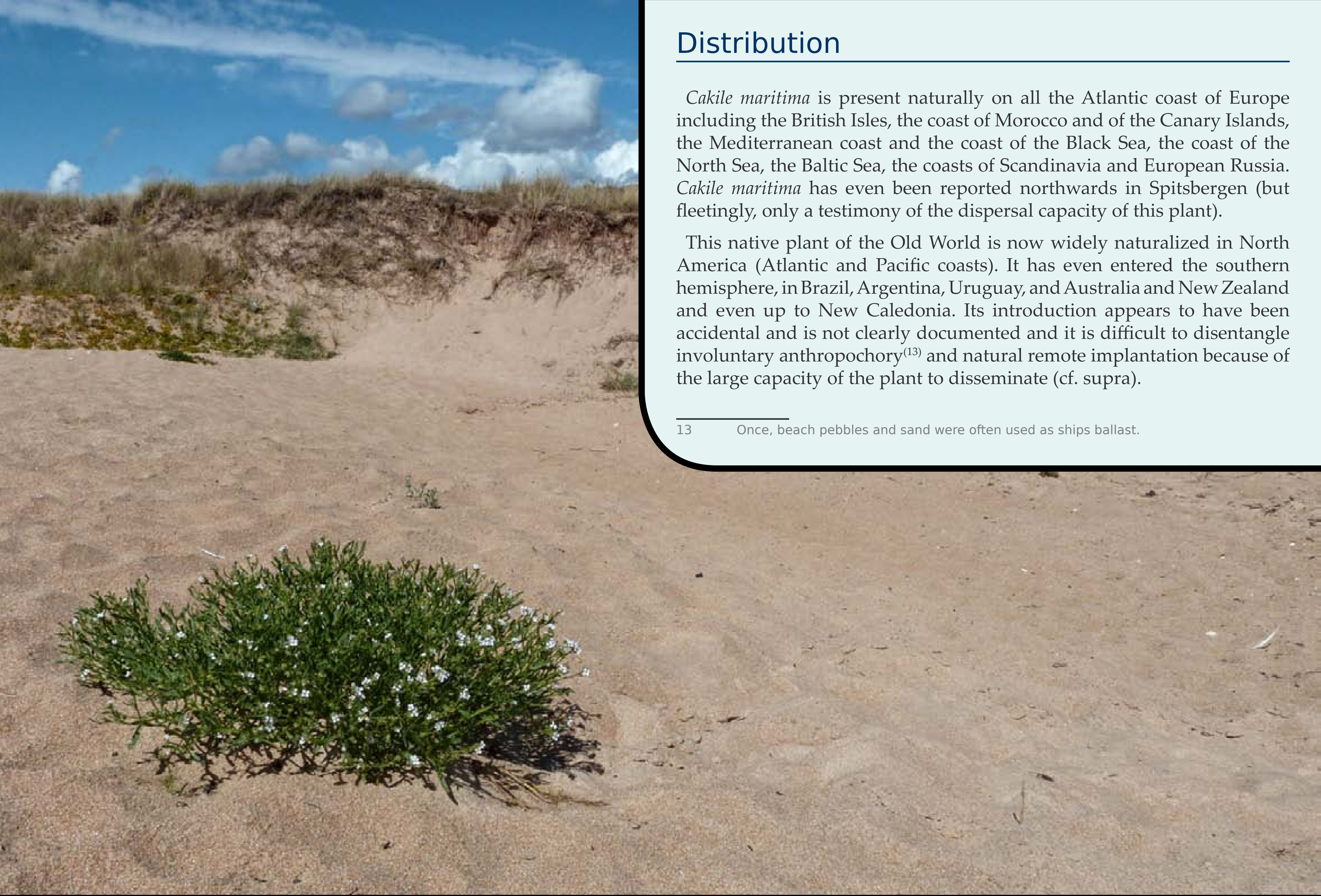
11 This seed abortion of proximal segments is particularly evident in the subsp. *integrifolia* from the Atlantic coast. In addition, there is some variation among individuals within a population, some practicing infanticide on a large scale and some other obviously having some qualms about it.

12 To say the truth, intelligence is well distributed in the *Brassicaceae* family and this type of indehiscent bisperm and breakable pod can be found more or less obviously in other plants, maritime or not; in maritime environments *Crambe maritima* L. and *Raphanus raphanistrum* subsp. *maritimus* (Sm.) Thell. can be mentioned, but none has taken the concept as far as *Cakile maritima* on the anatomical and physiological point of view.

It's the end of winter. These tufts of Cakile maritima growing back from the beach survived the storms, although the side facing the sea is damaged. Note the large size achieved by these old tufts and the large amount of sand they have trapped.



Distribution

Cakile maritima is present naturally on all the Atlantic coast of Europe including the British Isles, the coast of Morocco and of the Canary Islands, the Mediterranean coast and the coast of the Black Sea, the coast of the North Sea, the Baltic Sea, the coasts of Scandinavia and European Russia. *Cakile maritima* has even been reported northwards in Spitsbergen (but fleetingly, only a testimony of the dispersal capacity of this plant).

This native plant of the Old World is now widely naturalized in North America (Atlantic and Pacific coasts). It has even entered the southern hemisphere, in Brazil, Argentina, Uruguay, and Australia and New Zealand and even up to New Caledonia. Its introduction appears to have been accidental and is not clearly documented and it is difficult to disentangle involuntary anthropochory(13) and natural remote implantation because of the large capacity of the plant to disseminate (cf. supra).

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(13) Once, beach pebbles and sand were often used as ships ballast.

Cakile maritima has now become a nearly cosmopolitan species, but where it is located secondarily, it unfortunately tends to behave as an invasive species in coastal environments, gradually replacing native species (or treated as such) of *Cakile* as *Cakile edentula* (Bigelow) Hook, spontaneous in North America.

Cakile maritima in invasive situation in the southern hemisphere, on a beach in New Zealand [Opoutere, Coromandel Peninsula]

Uses

Snacking on a young leaf of *Cakile maritima* is one of the little known pleasures of a day at the beach...

Cakile maritima is an edible plant when young: young leaves, flowers and young fruits. As the name “Sea Rocket” suggests, it has a tangy taste that recalls both watercress (*Nasturtium officinale* R.Br.) and rocket (*Eruca sativa* Mill.) but more salty and is similarly used in salads. For that, it’s better to mix it with milder plants because its taste can be quite strong and spicy, but very nice and close to that of mustard(14) (*Brassica nigra* (L.) WDJKoch et spp. aff.), so it is closer to being a condiment than food. It should be noted that all listed plants are also *Brassicaceae*(15) and are botanically rather close to *Cakile maritima*.

If you eat this plant at a too advanced state, it becomes overly bitter and tough. The taproot is also sometimes eaten when young, raw or cooked, before it becomes fibrous and woody.

The whole plant being rich in vitamin C, it is an effective antiscorbutic and was once used for this purpose.

As with many *Brassicaceae*, its seeds are oleaginous, but so far *Cakile maritima* was never used for its oil, which is too rich in erucic acid for human consumption(16), but it could have a profitable industrial use. The interest and feasibility of cultivation of *Cakile maritima* are studied(17) and therefore this plant is a serious candidate for crops in dry climates and to rehabilitate soils degraded by progressive salinization (this is often the long-term consequences of irrational irrigation in hot, dry climates).

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(14) The characteristic mustard taste is due to the presence of glucosinolates.

(15) From a culinary point of view, *Brassicaceae* crops can be roughly divided into four groups: Cabbages (broadly defined), Mustards (broadly defined), Turnips (broadly defined) and, incidentally, Spoonworts, *Cakile maritima* and the other plants mentioned belong to the group of mustards.

(16) An European directive limits the level of erucic acid to a maximumof 5% in oils intended for human consumption.

(17) Gandour M. & al. ; How to optimize the seed and seed-oil production in the cash crop halophyte Cakile maritima, in *Journal of Medicinal Plants Research* 5(25): 5982-5987 (2011)

Legal protection

In **France**, *Cakile maritima* is not subject to any special protection.

In **Italia**, *Cakile maritima* is not subject to any special protection.

In North America and Australia, where it behaves as an introduced invasive, one would try rather to get rid of it than to protect it!

A bit of nomenclature...

Cakile maritima Scop., *Fl. Carniol.*, éd. 2, 2: 35 (1772)

Family: *Brassicaeae* (nom. altern. *Cruciferae*)

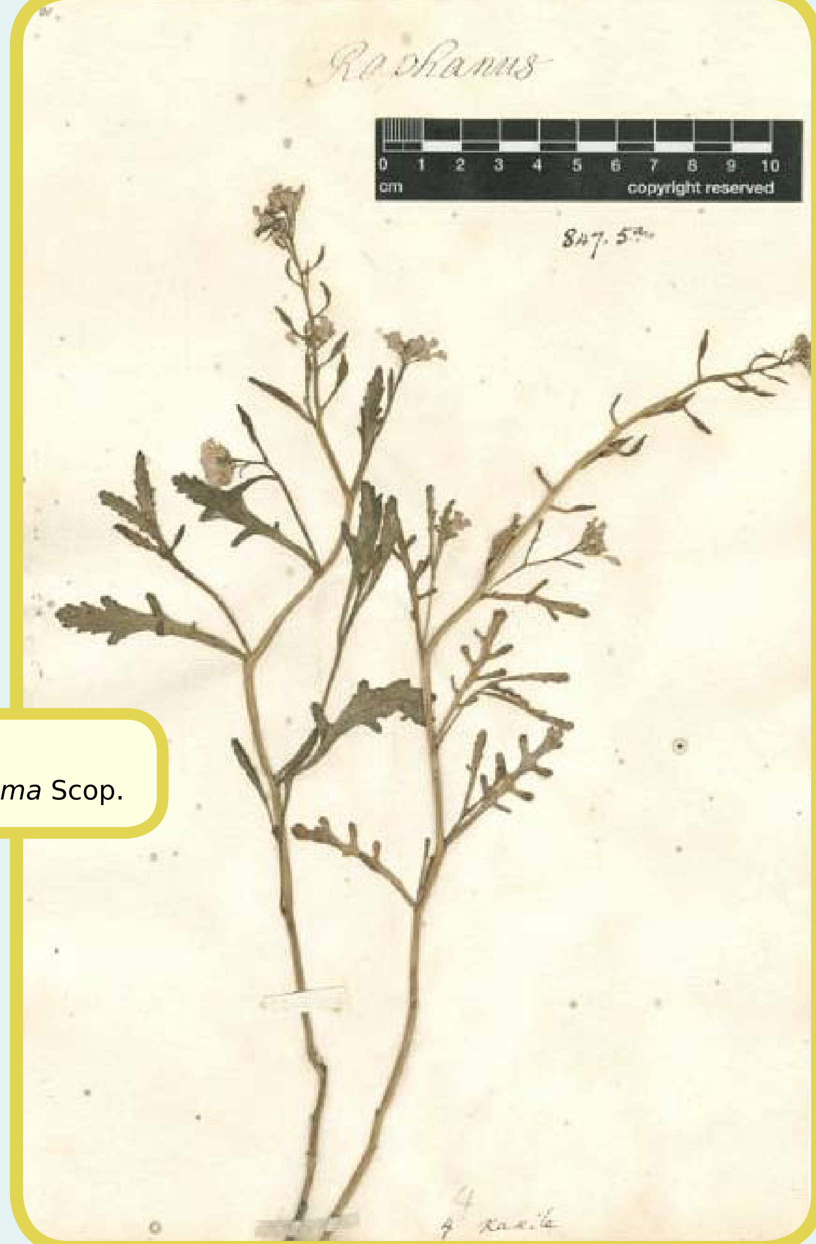
Typus: (Lectotypus) [*Bunias cakile*] leg. anonym., s.n., sine loco, LINN 847.5a, dextr. specim. / design. Elven in Jonsell & Jarvis (ed.), *Nordic J. Bot.* 22 : 68 (2002)

Synonymy:

≡ [basionym] *Bunias cakile*. L., *Sp. Pl.*, 1: 670 (1753)
≡ *Bunias littoralis* Salisb., nom. nov.
≡ *Cakile cakile* (L.) Karsten,
≡ *Crucifera cakile* (L.) Karsten
≡ *Rapistrum cakile* (L.) Crantz, *Class. Crucif.*: 106 (1769)
≡ *Rapistrum maritimum* (Scop.) Berger)

Chromosome number: 2n = 18 (18).

The word Cakile comes from Arabic and is probably related to an ancient medicinal use of the plant.



LINN 847a.
Lectotype of *Cakile maritima* Scop.

Common names

(**GB**) Searocket.

(**FR**) Roquette de mer, Cakilier maritime.

(**IT**) Ravastrello marittimo, rucola di mare, ruchetta marina, baccherone.

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[18] Warwick S.I. & al. (2009), *Guide to Wild Germplasm Brassica and allied crops*, ed. 3.

Subspecific taxa

The morphological variability and the large area of distribution of this species has led to distinguish some geographical subspecies where the distinction is largely based on the size and morphology of the fruit and where the individualization is questionable because of the existence of intermediate forms and a wide variation in the morphology of the fruit in the same geographical area or in the same population. This imperfect separation between the various subspecific taxa is not surprising according to the capacity of the seeds of this plant for long distance dissemination and the inevitable mixing between populations that follows. All the subspecies listed below actually form a large *continuum* without neat internal limits. The subspecific nomenclature of *Cakile maritima* is actually more complex than what follows, because crowded with many other taxa at various ranks, seeming even more questionable than the few large frameworks to which we will limit ourselves here.

• *Cakile maritima* subsp. *maritima*

Coasts of the western Mediterranean basin.

The lateral projections of the fruit are well marked and prominent, and the separation between the two segments is arrowhead shaped.

Synonymy:

= *Cakile hispanica* Jord., *Diagn. Esp. Nouv.* : 345 (1864)
  ≡ *Cakile aegyptica* var. *hispanica* (Jord.) Maire
  ≡ *Cakile maritima* var. *hispanica* (Jord.) Paol.

Cakile maritima **subsp.** *integrifolia*

Cakile maritima **subsp.** *integrifolia*

- ***Cakile maritima*** subsp. ***integrifolia*** (Hornem.) Hyl. ex Greuter & Burdet

Cakile maritima subsp. *integrifolia* (Hornem.) Hyl. ex Greuter & Burdet, *Med-Checklist* 3: 74 (1986)

Typus: « Fl. D. T. 1583 ».

Coasts of the Atlantic and the North Sea up to southern Scandinavia.

Synonymy:

≡ [basionym] *Cakile maritima* var. *integrifolia* Hornem., *Fors. Oecon. Plantel.*, éd. 3, 1 : 709 (1821)

The lower segment of the fruit is often more or less atrophied, much smaller than in the type, its lateral projections are less marked, and the separation between the two segments is almost flat. Note that the word *integrifolia* ("with entire leaf") should not be interpreted literally, the leaves of this taxon are not less lobed than the type.

- ***Cakile maritima*** subsp. ***baltica*** (Jord. ex Rouy & Foucaud) Hyl. ex P.W.Ball

Cakile maritima subsp. *baltica* (Jord. ex Rouy & Foucaud) Hyl. ex P.W.Ball in *Feddes Repert*. 69: 37 (1964)

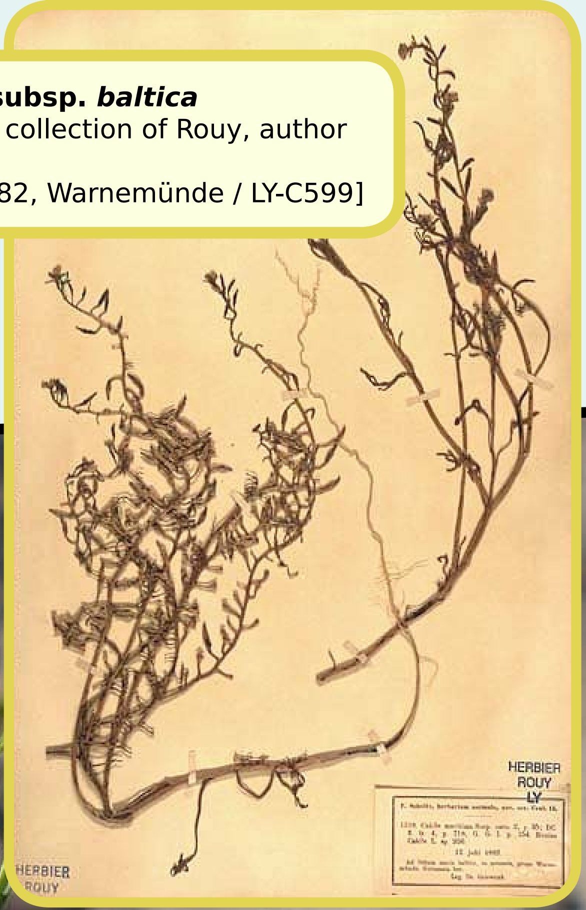
Syntypi [*Cakile maritima* f. *baltica*] : leg. F.Schultz, n° 1318 ; Herb. norm., nov. ser. // leg. Reichb. n° 361.

Coast of the Baltic Sea.

Leaves more lobed (sometimes bipinnatifid) than those of the type.

Synonymy:

≡ [basionyme] *Cakile maritima* [subsp.] *baltica* Jord. ex Rouy & Foucaud, *Flore de France* 2: 69-70 (1895)
≡ *Cakile baltica* Jord., *Diagn. Esp. Nouv.* : 345 (1864) (in obs.) [nom. nud.]
≡ *Cakile baltica* (Jord. ex Rouy & Foucaud) Pobed.
≡ *Cakile maritima* var. *baltica* (Jord. ex Rouy & Foucaud) Paol.
= *Cakile maritima* var. *bipinnata* O.E.Schulz



Cakile maritima* subsp. *baltica
Specimen from the collection of Rouy, author of the taxon.
[leg. Griewank, 1882, Warnemünde / LY-C599]

Cakile maritima **subsp.** *baltica*

Kenraiz / Wikimedia Commons

- ***Cakile maritima*** subsp. ***aegyptiaca*** (L.) Nyman

Cakile maritima subsp. *aegyptiaca* (L.) Nyman, *Consp. Fl. Eur.* : 29 1878)

Typus [*Isatis aegyptica* L.] non designatus ?

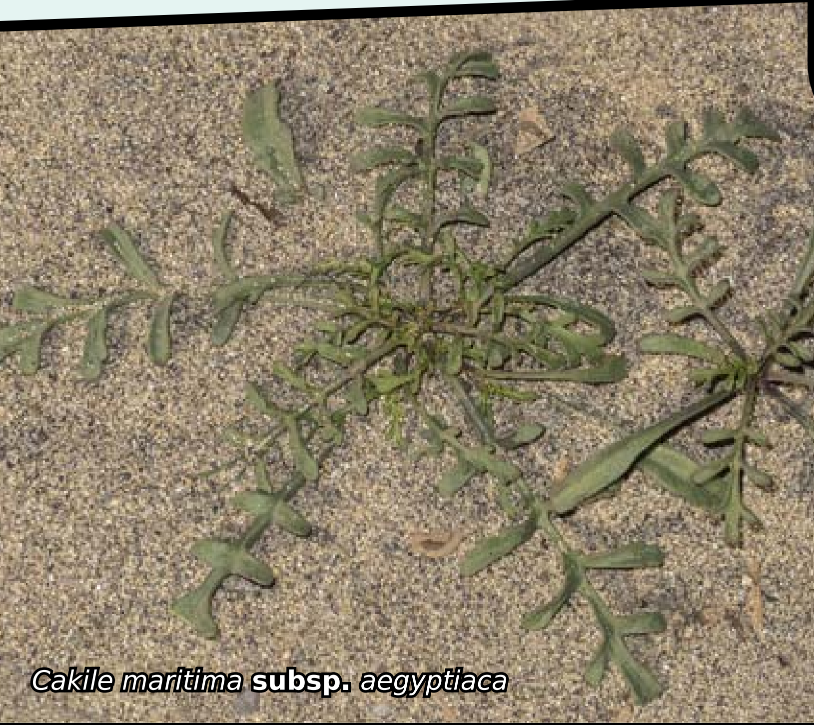
Coasts of the eastern Mediterranean basin.

Very variable morphology and little distinction except the geographic frame...

Synonymy:

≡ [basionyme] *Isatis aegyptiaca* L., *Sp. Pl.* 2: 671 (1753) (pro “*aegyptica*”)
≡ *Cakile aegyptiaca* (L.) Willd.
≡ *Cakile maritima* var. *aegyptiaca* (L.) Delile
≡ *Cakile maritima* subsp. *aegyptiaca* (L.) Nyman

NB : the Linnaean spelling *aegyp**tica*** is a misprint which must be corrected to *aegyp**tiaca***.



Cakile maritima **subsp.** *aegyptiaca*

Cakile maritima **subsp.** *aegyptiaca*


Cakile maritima **subsp.** euxina

D. Panco

- ***Cakile maritima*** subsp. ***euxina*** (Pobed.) Nyár.

Cakile maritima subsp. *euxina* (Pobed.) Nyár., in Savulescu, *Fl. Rep. Pop. Române* 3: 480 (1955)

Typus [*Cakile euxina* Pobed.] : leg. Pobedimova, n°48, 1947-08-15 ; « prope oppidum Scadowsk » ; Holotypus LE, Isotypi A, MO, NY US.

Coasts of the Black Sea.

Leaves more lobed (sometimes bipinnatifid) than those of the type. Fruit without an obvious neck at segmentation area.

Synonymy:

≡ [basionyme] *Cakile euxina* Pobed., *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R.* 15: 71. (1953)


Cakile maritima **subsp.** euxina

D. Panco

Cakile maritima subsp. islandica
[pro *Cakile lapponica* (Isotype), leg. Pobed, s.n. - MO-357224]

Cakile maritima* subsp. *islandica
[BG-205840, pro *Cakile arctica*]

- ***Cakile maritima*** subsp. ***islandica*** (Gand.) Elven

Cakile maritima subsp. *islandica* (Gand.) Elven, in *Nordic J. Bot*. 16(1): 8 (1996)

Typus : leg. Jönsson, n°602 ; Islande : Hellnar ; Holotypus LY ?

Iceland, coasts of Scandinavia and European Russia. Reported occasionally up to Spitsbergen but without permanent installation.

The flowers are smaller than those of the type, the fruit is quite long and its lateral projections are few marked. The indented middle part of the leaf blade is rather wide.

Synonymy:

≡ [basionyme] *Cakile maritima* f. *islandica* Gand., in *Bull. Soc. Bot. France* 47: 343 (1900)
≡ *Cakile edentula* subsp. *islandica* (Gand.) Á. Löve & D. Löve
≡ *Cakile edentula* var. *islandica* (Gand.) Á. Löve
= *Cakile arctica* Pobed., *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR* 15: 64 (1953).
= *Cakile lapponica* Pobed., *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR* 19: 44 (1959).

Cultivation notes

Cakile maritima is certainly one of the easiest maritime plants to grow outside its natural environment because its ecological latitude is wide and, importantly, it does not necessarily require a salty soil to thrive; the presence of salt at a high level is well tolerated by the plant, but is not an actual physiological need. Studies on this subject(19) are slightly discordant on the positive or negative effect on growth, of various concentrations of sodium chloride (NaCl) of the substrate. One thing is sure: if the stimulating effect on growth of salt intakes is real (slight increase of the weight in dry matter) it is low and not obvious outside of laboratory measurements(20). However, it seems that the presence of salt, in the absence of clearly stimulated growth, does increase the succulence of the stem and leaves, which can be worthwhile from an ornamental point of view.

Cakile maritima is not very suitable for growing in pots because of the great length of its taproot. It will be better in the ground in the garden, in full sun, preferably in light and rich soil. However, cultivation in a deep pot enables better control of possible intakes of salt (a pinch from time to time or some watering with pure or diluted seawater).

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19 Debez A. & al., Salinity effects on germination, growth, and seed production of the halophyte Cakile maritima, in *Plant and Soil* 252(1-2): 179-189 (2004) / Megdiche W. & al., Salt tolerance of the annual halophyte Cakile maritima as affected by the provenance and the developmental stage, in *Acta Physiologiae Plantarum* 29: 375-384 (2007).

20 Diallo N. (1980), Adaptation du métabolisme à la présence de NaCl, cas du Cakile maritima et du Kalanchoe blossfeldiana, Thèse Paris-6.

Propagation

Reproduction of *Cakile maritima* is preferably carried out by sowing in spring, but it can be sown throughout all the summer because the growth of seedlings is fast and so they overwinter easily.

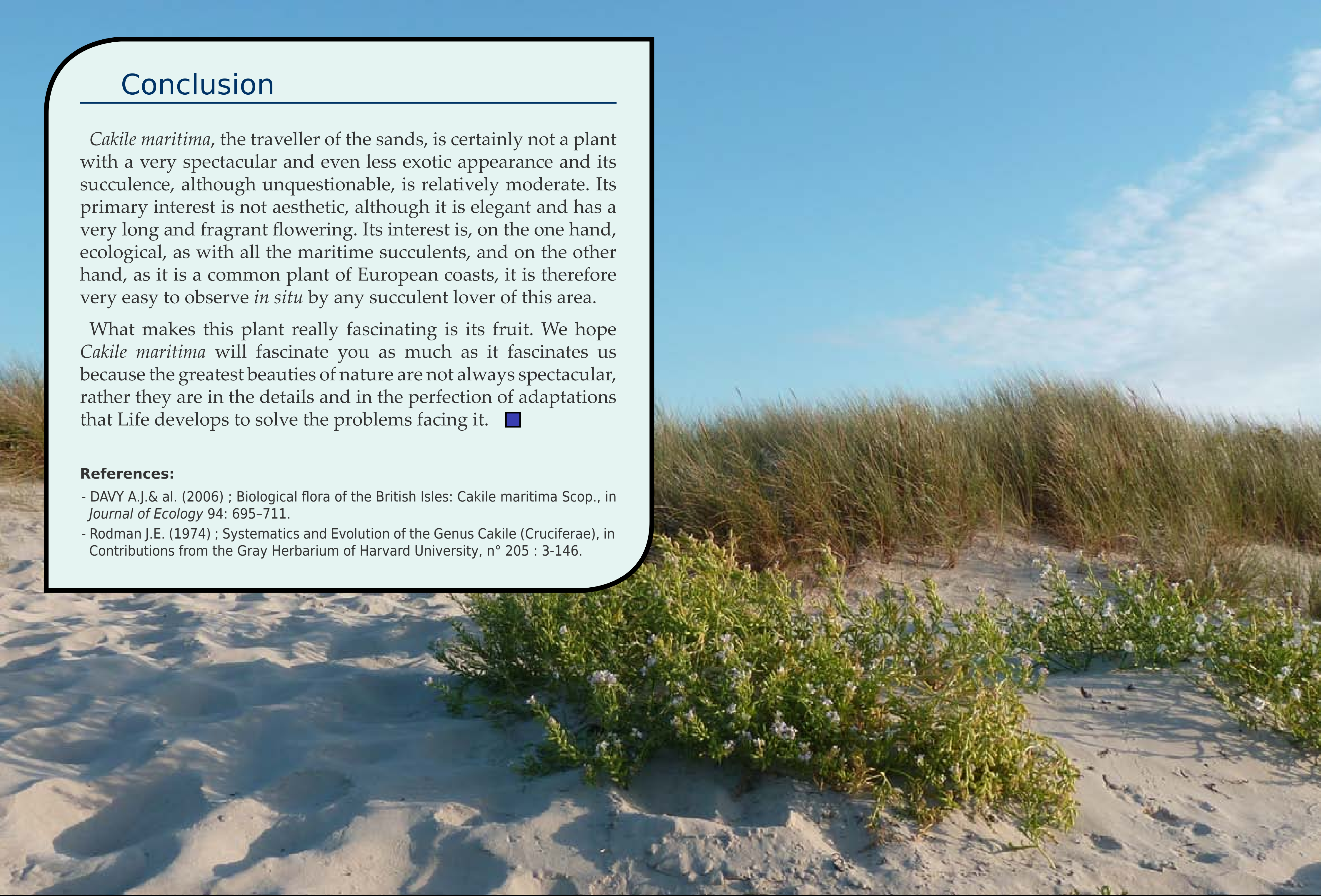
Seeds keep their viability for many years (6-10 years). The germination rate is higher if the corky envelope that protects the seed is removed (in nature, this degradation is mechanically and biologically carried out by the action of sea and sand). The seeds need to be stored in a cold place during the winter to help to stop their dormancy. You can also sow during the fall for emergence in the spring. When sowing, do not forget to cover the seeds under several centimetres of substrate, at least 2 cm (see above: *Ecology*).

Like many halophytes, germination of *Cakile maritima* is much better in unsalted or temporarily desalted environment because high salinity inhibits germination, allowing prolonged transport of the seeds by seawater (thalassochory).

It is also possible to make cuttings of this plant but it is of little interest compared to sowing, except that of propagating a particularly interesting clone, regular cuttings are necessary in this case because of the short life of the plant.

Where to get this plant?

Seeds of *Cakile maritima* are not very common in the traditional trade but are available and cheap by looking around on the Internet. It is also possible to find seedlings in a few nurseries specialized in Seaside plants and some also sell over the Internet.



Conclusion

Cakile maritima, the traveller of the sands, is certainly not a plant with a very spectacular and even less exotic appearance and its succulence, although unquestionable, is relatively moderate. Its primary interest is not aesthetic, although it is elegant and has a very long and fragrant flowering. Its interest is, on the one hand, ecological, as with all the maritime succulents, and on the other hand, as it is a common plant of European coasts, it is therefore very easy to observe *in situ* by any succulent lover of this area.

What makes this plant really fascinating is its fruit. We hope *Cakile maritima* will fascinate you as much as it fascinates us because the greatest beauties of nature are not always spectacular, rather they are in the details and in the perfection of adaptations that Life develops to solve the problems facing it. ■

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- Rodman J.E. (1974) ; Systematics and Evolution of the Genus Cakile (Cruciferae), in Contributions from the Gray Herbarium of Harvard University, n° 205 : 3-146.

Notes about some threats to *Epithelantha ilariae* in three of its natural locations

by Manuel Nevárez de los Reyes

A la memoria de mi padre, Sr. Francisco Nevárez Andrade
(1 de julio de 1926 - 15 de enero de 2014)

In loving memory of my father Mr. Francisco Nevárez Andrade
(July 1, 1926 - January 15, 2014)

Epithelantha bokei

J. Jauernig

Epithelantha micromeris

THE genus *Epithelantha* F.A.C.Weber ex Britton & Rose was considered for very long time a monotypic genus, with the single species, *Epithelantha micromeris* F.A.C.Weber, or following some authors, composed of two distinct species, *Epithelantha micromeris* and *E. bokei* L.D.Benson, but reported as extremely variable (Anderson, 2001).

Epithelantha greggii subsp. polycephala

In depth research on the complete distributional range of all the putative taxa belonging to the genus by Donati & Zanovello (2010, 2011), was followed by a nomenclatural revision of the whole genus which concluded that the genus *Epithelantha* is composed of 7 distinct species, some of them distinguishable as subspecies, with a total of 13 distinct nomenclatural types.


Epithelantha unguispina


E. pachyrhiza subsp. parvula


Epithelantha greggii

Nomenclature of the genus *Epithelantha*

Following Donati & Zanovello (2010)

Epithelantha Weber ex Britton & Rose
- ***E. bokei*** Benson
- ***E. cryptica*** D.Donati & C.Zanovello
- ***E. ilariae*** D.Donati & C.Zanovello
- ***E. greggii*** (Eng.) Orcutt
  - ***E. greggii*** subsp. ***greggi***
  - ***E. greggii*** subsp. ***polycephala*** (Backeb.) D.Donati & C.Zanovello
  - ***E. greggii*** subsp. ***potosina*** D.Donati & C.Zanovello
- ***E. micromeris*** (Eng.) Britton & Rose [typus generis]
- ***E. pachyrhiza*** (Marsh.) Backeb.
  - ***E. pachyrhiza*** subsp. ***pachyrhiza***
  - ***E. pachyrhiza*** subsp. ***elongata*** (Backeb.) D.Donati & C.Zanovello
  - ***E. pachyrhiza*** subsp. ***parvula*** D.Donati & C.Zanovello
  - ***E. pachyrhiza*** subsp. ***pulchra*** D.Donati & C.Zanovello
- ***E. unguispina*** (Boed.) D.Donati & C.Zanovello
  - ***E. unguispina*** subsp. ***unguispina***
  - ***E. unguispina*** subsp. ***huastecana*** D.Donati & C.Zanovello


Epithelantha pachyrhiza


Epithelantha bokei


Epithelantha ilariae

Epithelantha ilariae

Epithelantha ilariae D.Donati & C.Zanovello, in *Piante Grasse* 30(4): 165-187 (2010)

Typus: leg. Hinton & al., 29075, "MEXICO. Nuevo Leon, Mpio. Cienega deFlores, North of Monterrey, gravelly slope, bushy area, 430 m, June 2009"; Holotypus GBH, Isotypus MEXU.

Epithelantha ilariae is very similar in its morphology to *E. bokei*, but many characteristics separate the two species:

- the number of spine per areole of *E. ilariae* is lower, arranged in much less, superposed layers;
- Its spines have an elliptic section, instead of an applanate section as in *E. bokei*;
- The spine epidermis of *E. ilariae* is evidently waxy-white, especially during the juvenile phase, in *E. bokei* it's only slightly waxy or not at all;
- The flowering period of *E. bokei* is March/July, whilst the flowering period of *E. ilariae* is March/October;
- The most important characteristic which distinguishes *E. ilariae* from *E. bokei* is the lack of evident denticles on the spine margins, which is a peculiar characteristic of *E. bokei* in the genus *Epithelantha*.
- Last but not least, *E. ilariae* is the species of *Epithelantha* which grows at the lowest altitude, as it's found between 300 and 500 asl.


Epithelantha ilariae, an old very large individual.

The legal protection of the genus *Epithelantha*

After the publication of the revision of the genus *Epithelantha*, the abovementioned taxonomical changes were not applied in NOM 059 SEMARNAT 2010(1), which repeated the same situation as NOM 059 SEMARNAT 2001, where only one species of *Epithelantha* is listed, with two subspecies: *Epithelantha micromeris bokei* [*sic*] (≡ *Epithelantha bokei*) is listed as "especie Amenazada" (threatened species), *Epithelantha micromeris micromeris* [*sic*] (≡ *Epithelantha micromeris*) is listed in "categoría de Protección Especial" (plant worthy of special protection).

Despite thinking that it should be obvious that any new taxa described after a similar taxonomical revision should have the same legal protection as the species in which they were included (*Epithelantha micromeris)*, this was not applied by Mexican Law, so *Epithelantha ilariae* and the rest of the new taxa described are not listed in any protection category in the NOM 059.

The goal of this document is to highlight the current threats of some populations of *Epithelantha ilariae* in three distinct localities of its geographical distribution area, in order to suggest the inclusion of *E. ilariae* in one of the protection categories of the next version of NOM 059.

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1 Environmental protection – Native Mexican species of wild Flora and Fauna – Category of the risk and specification for the inclusion, exclusion or change of list for endangered species.


Epithelantha ilariae

The threatened populations

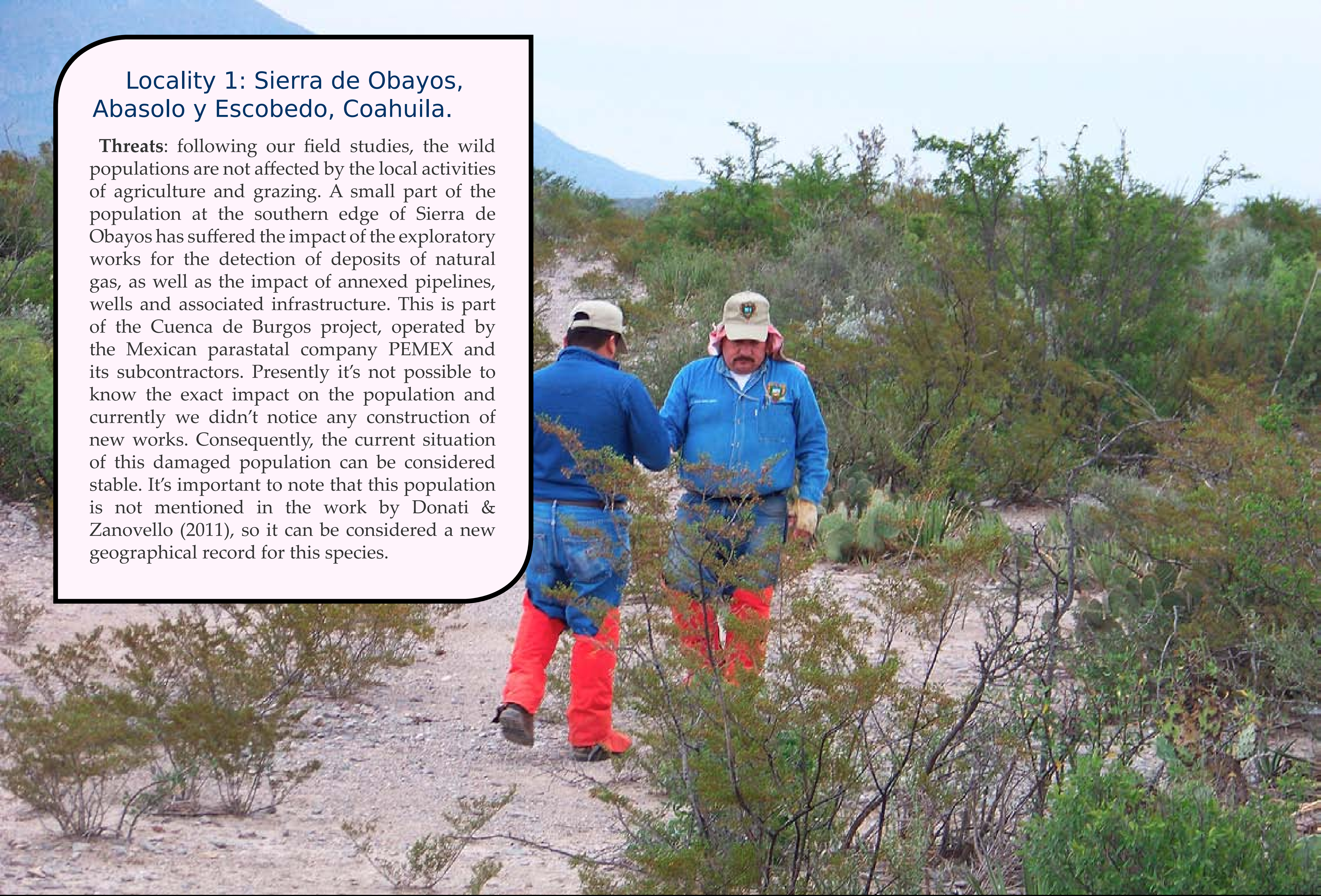
Epithelantha ilariae is found in Mexico from the southern slopes of Sierra de Obayos, around 50 km north of Monclova, Coahuila, and its distribution is a sort of wide band which ends north of Montemorelos, Nuevo León, and includes the small sierras (mountain chains) which surround the metropolitan area of Monterrey City, Nuevo León.

1 Sierra de Obayos, Abasolo y Escobedo, Coahuila.

2 Western slope of the Sierra de Gomas, Bustamante, Nuevo León.

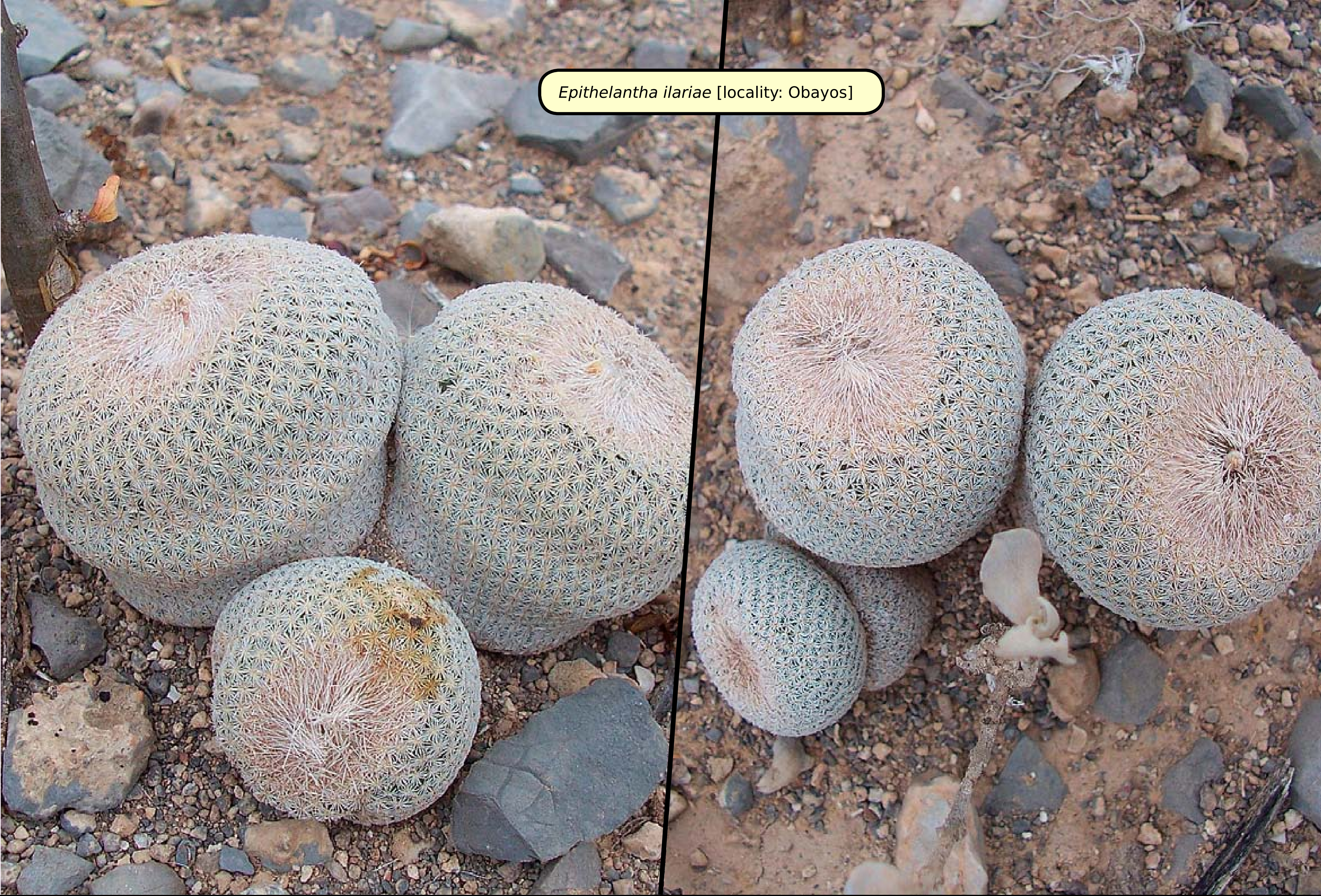
3 Lomeríos de Ciénega de Flores, Higueras y Zuazua, Nuevo León.

🟥 Global area of *Epithelantha ilariae*

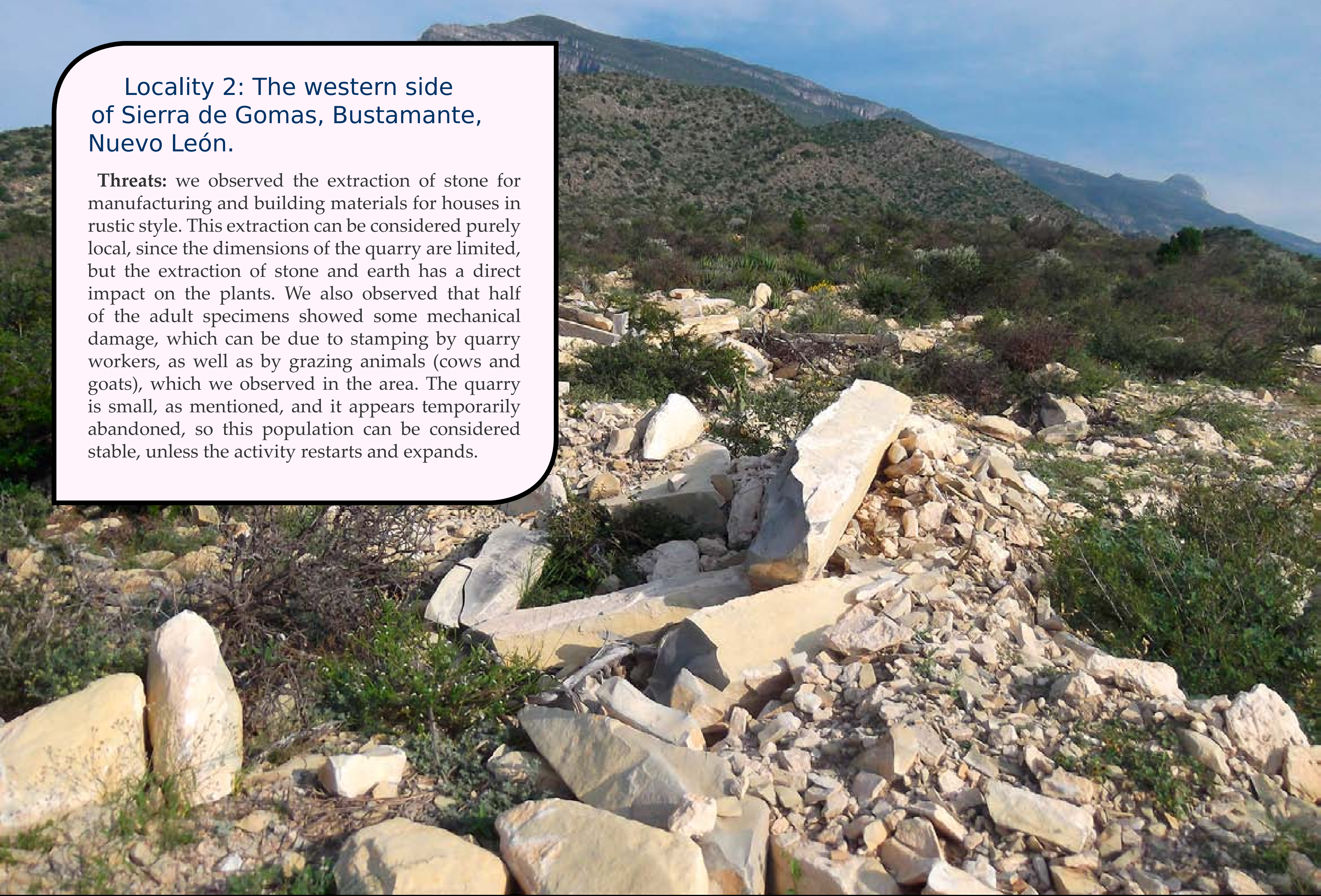


Locality 1: Sierra de Obayos, Abasolo y Escobedo, Coahuila.

Threats: following our field studies, the wild populations are not affected by the local activities of agriculture and grazing. A small part of the population at the southern edge of Sierra de Obayos has suffered the impact of the exploratory works for the detection of deposits of natural gas, as well as the impact of annexed pipelines, wells and associated infrastructure. This is part of the Cuenca de Burgos project, operated by the Mexican parastatal company PEMEX and its subcontractors. Presently it's not possible to know the exact impact on the population and currently we didn't notice any construction of new works. Consequently, the current situation of this damaged population can be considered stable. It's important to note that this population is not mentioned in the work by Donati & Zanovello (2011), so it can be considered a new geographical record for this species.



Epithelantha ilariae [locality: Obayos]



Locality 2: The western side of Sierra de Gomas, Bustamante, Nuevo León.

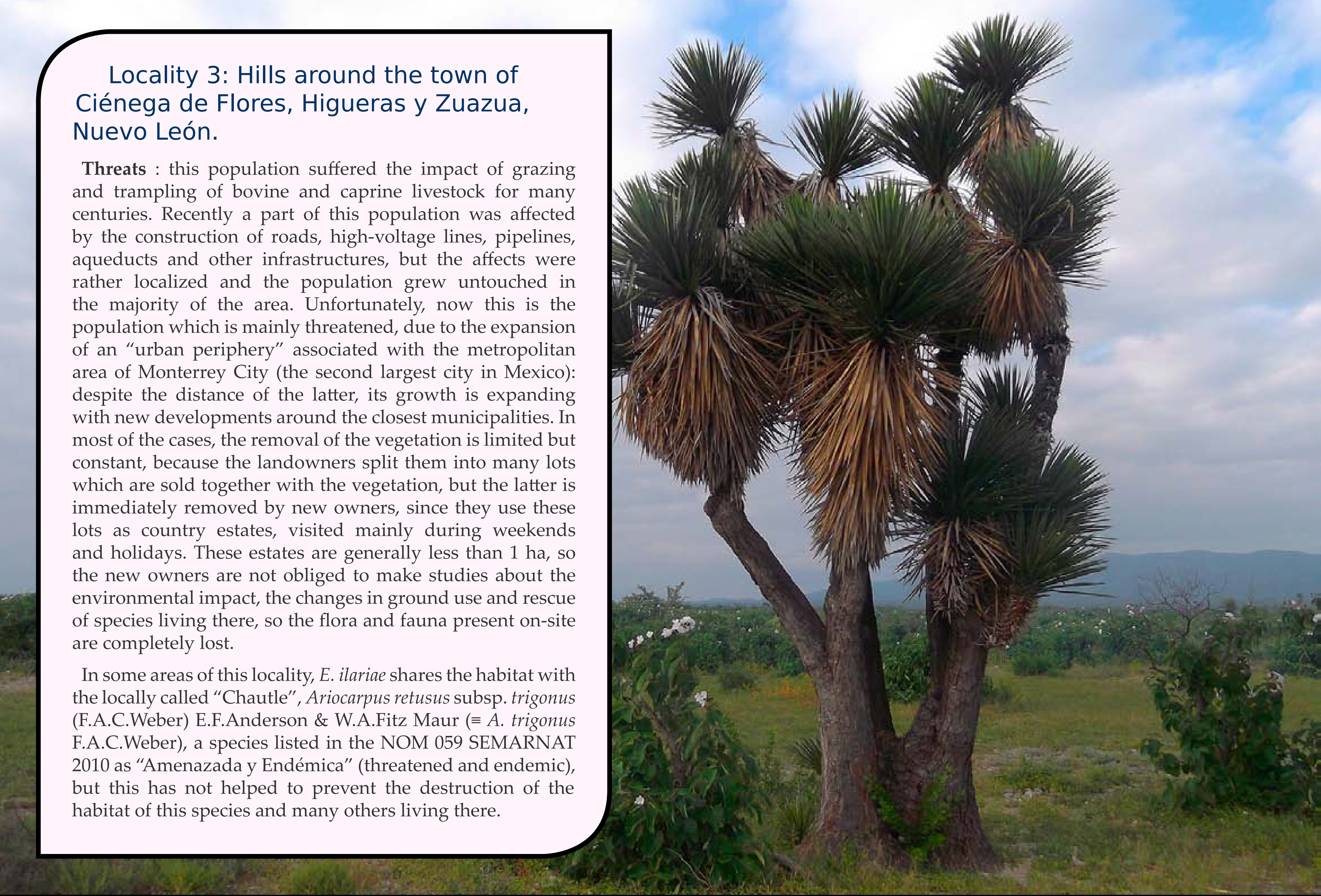
Threats: we observed the extraction of stone for manufacturing and building materials for houses in rustic style. This extraction can be considered purely local, since the dimensions of the quarry are limited, but the extraction of stone and earth has a direct impact on the plants. We also observed that half of the adult specimens showed some mechanical damage, which can be due to stamping by quarry workers, as well as by grazing animals (cows and goats), which we observed in the area. The quarry is small, as mentioned, and it appears temporarily abandoned, so this population can be considered stable, unless the activity restarts and expands.

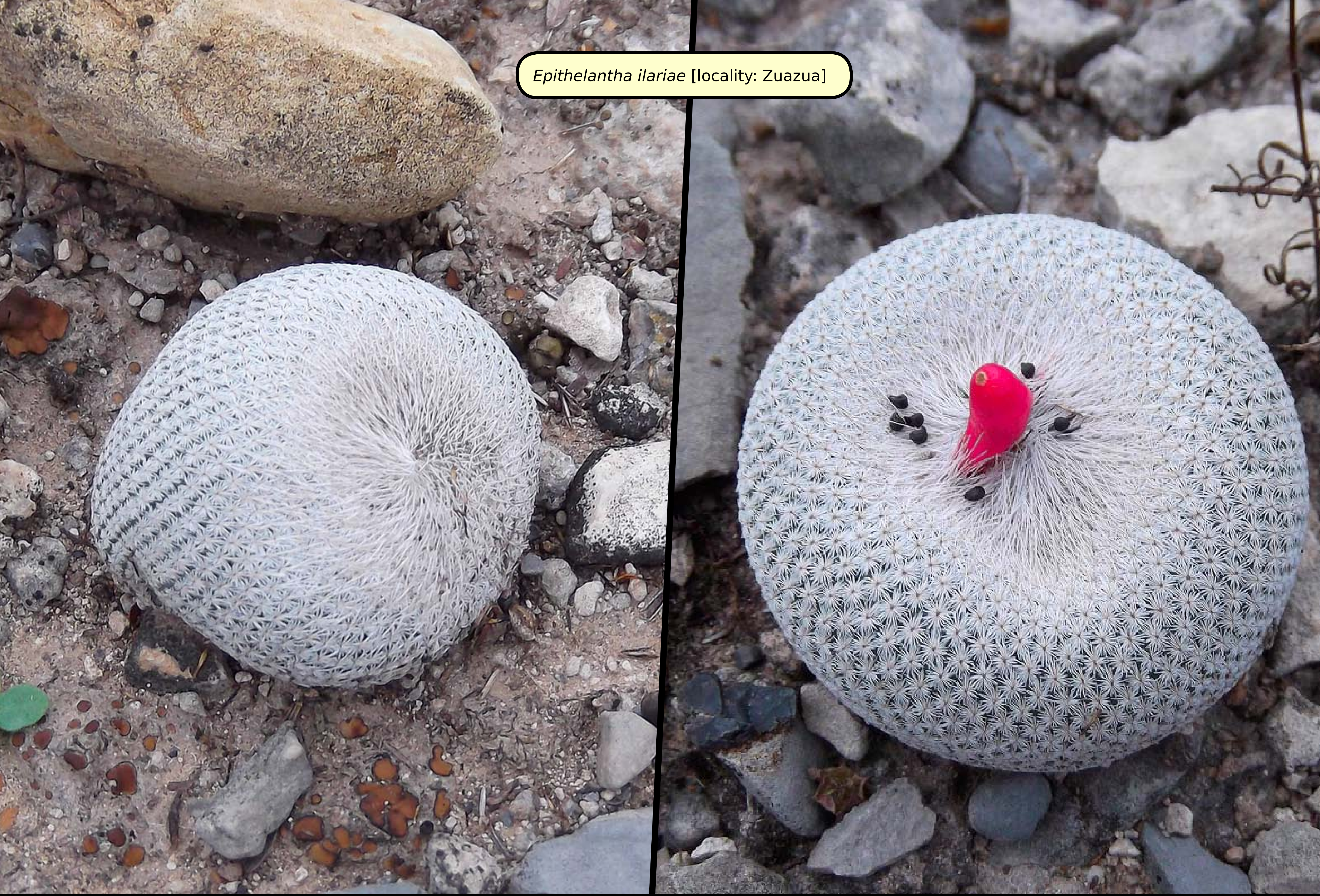
Epithelantha ilariae [locality: Bustamante]
Plants damaged by the activities of the quarry.

Locality 3: Hills around the town of Ciénega de Flores, Higueras y Zuazua, Nuevo León.

Threats : this population suffered the impact of grazing and trampling of bovine and caprine livestock for many centuries. Recently a part of this population was affected by the construction of roads, high-voltage lines, pipelines, aqueducts and other infrastructures, but the affects were rather localized and the population grew untouched in the majority of the area. Unfortunately, now this is the population which is mainly threatened, due to the expansion of an "urban periphery" associated with the metropolitan area of Monterrey City (the second largest city in Mexico): despite the distance of the latter, its growth is expanding with new developments around the closest municipalities. In most of the cases, the removal of the vegetation is limited but constant, because the landowners split them into many lots which are sold together with the vegetation, but the latter is immediately removed by new owners, since they use these lots as country estates, visited mainly during weekends and holidays. These estates are generally less than 1 ha, so the new owners are not obliged to make studies about the environmental impact, the changes in ground use and rescue of species living there, so the flora and fauna present on-site are completely lost.

In some areas of this locality, *E. ilariae* shares the habitat with the locally called "Chautle", *Ariocarpus retusus* subsp. *trigonus* (F.A.C.Weber) E.F.Anderson & W.A.Fitz Maur (≡ *A. trigonus* F.A.C.Weber), a species listed in the NOM 059 SEMARNAT 2010 as "Amenazada y Endémica" (threatened and endemic), but this has not helped to prevent the destruction of the habitat of this species and many others living there.





Epithelantha ilariae [locality: Zuazua]

Conclusion

We can conclude that for the conservation of *Epithelantha ilariae*, legal protection alone is not sufficient, since one of the most important things is always a better knowledge and attachment to Nature of the people, and involving all the community in this.

An analysis of the distribution and the numerical consistency of the wild populations of each species and subspecies belonging to the genus *Epithelantha* is very important. Considering that practically all of them have a geographical distribution range more limited than *E. bokei*, we recommend that they are included in the same protection category as the latter, which is "especie Amenazada", threatened species. In this context, the protection of the very threatened population of *E. ilariae* growing north of the metropolitan area of Monterrey City will be the first goal, integrating its preservation in the urban development plan. ■

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- Donati D. & Zanovello C., 2011, *Epithelantha* 2011, Cactus Trentino Südtirol : 64 pp.
- NORMA Oficial Mexicana NOM-059-SEMARNAT-2001, Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo. Diario Oficial de la Federación, 06 de marzo de 2002.
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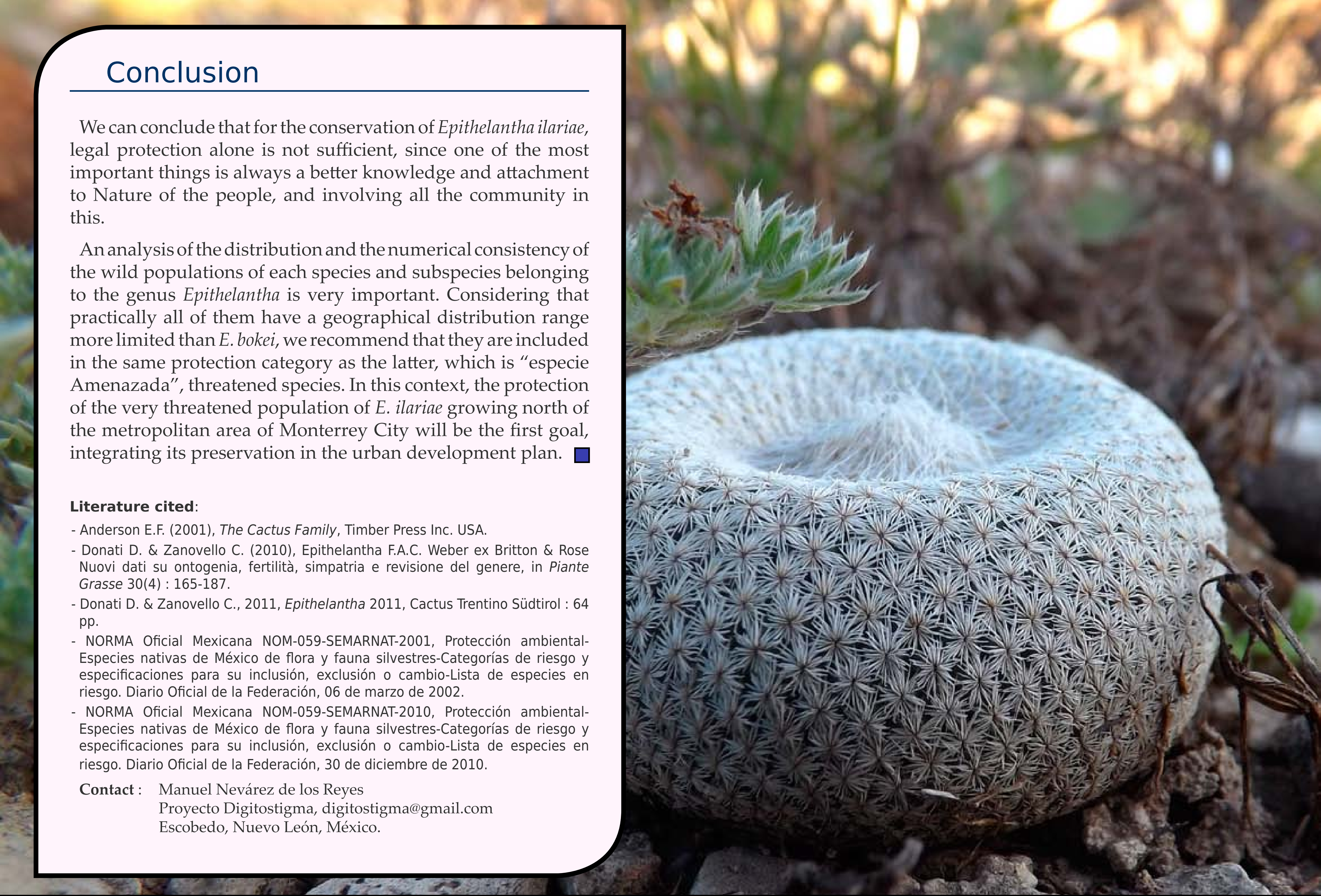
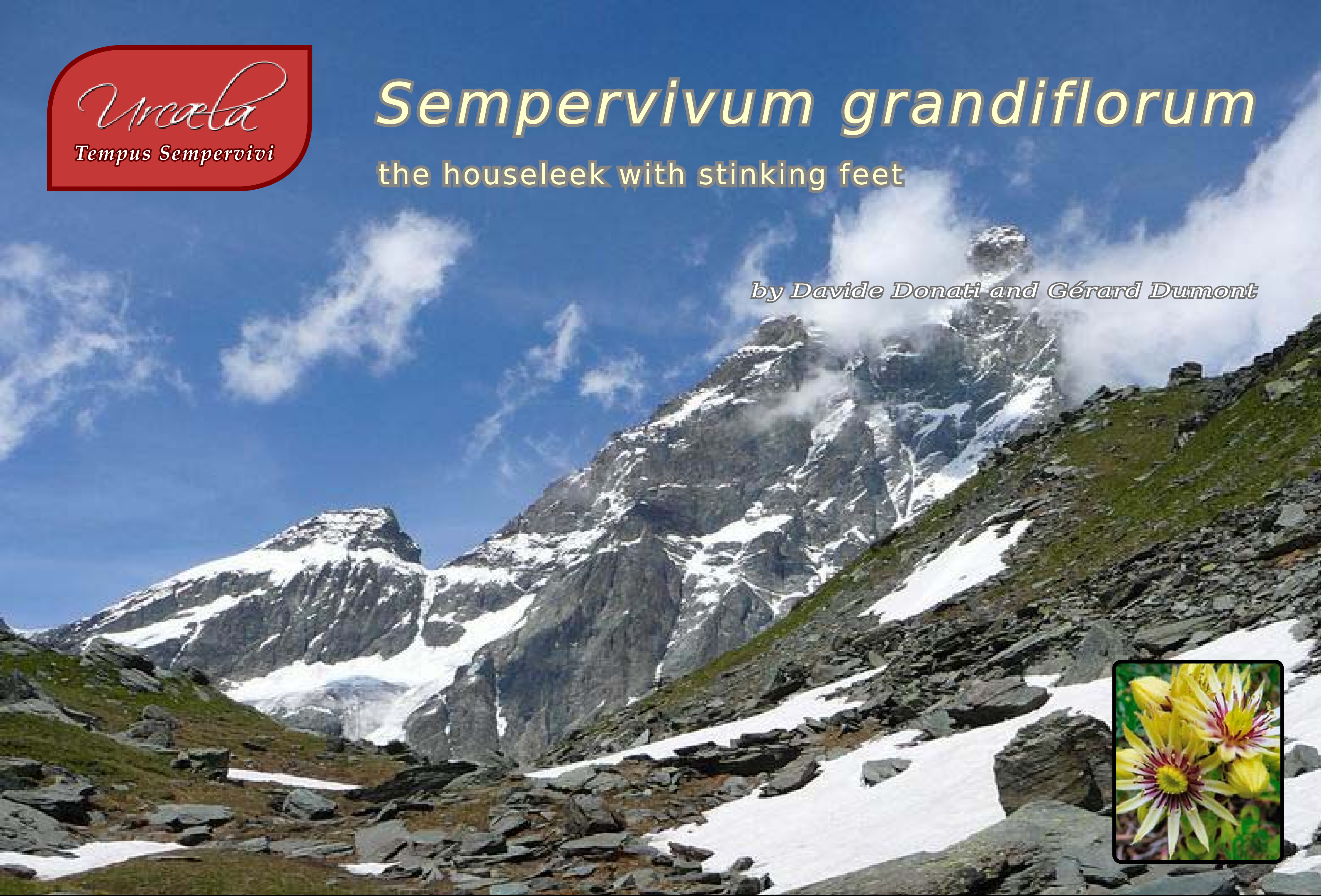


Urceola
Tempus Sempervivi

Sempervivum grandiflorum

the houseleek with stinking feet

by Davide Donati and Gérard Dumont



Houseleeks (genus *Sempervivum* L.) have a reputation for being difficult to identify, particularly when trying to distinguish one species from another. This if often true, but the houseleek we are going to present to you now, doesn't follow this rule at all: not only is *Sempervivum* Haw. rather easy to identify, you can even do it with your eyes closed. We aren't joking; it's really easy to identify a plant when it stinks like, well...dirty socks. Wait a minute, don't turn the page; despite this evocative smell, it's a wonderful sock... sorry, plant.

Description

Clump: rather compact but usually not very dense, since the daughter-rosettes are produced in limited quantities, replacing the monocarpic adult rosettes rather slowly. The stolons are usually rather robust and relatively persistent, short or middle-sized, their length barely exceeding the diameter of the mother-rosette (a slightly longer length can occur in cultivated plants); some individuals show longer and thinner stolons (without obvious connection with hybridity); the rosette doesn't produce any stolons during the flowering year.

Adult rosette: rather open and not very compact, with relatively few, regularly arranged leaves, generally showing a scarce anisophylly.

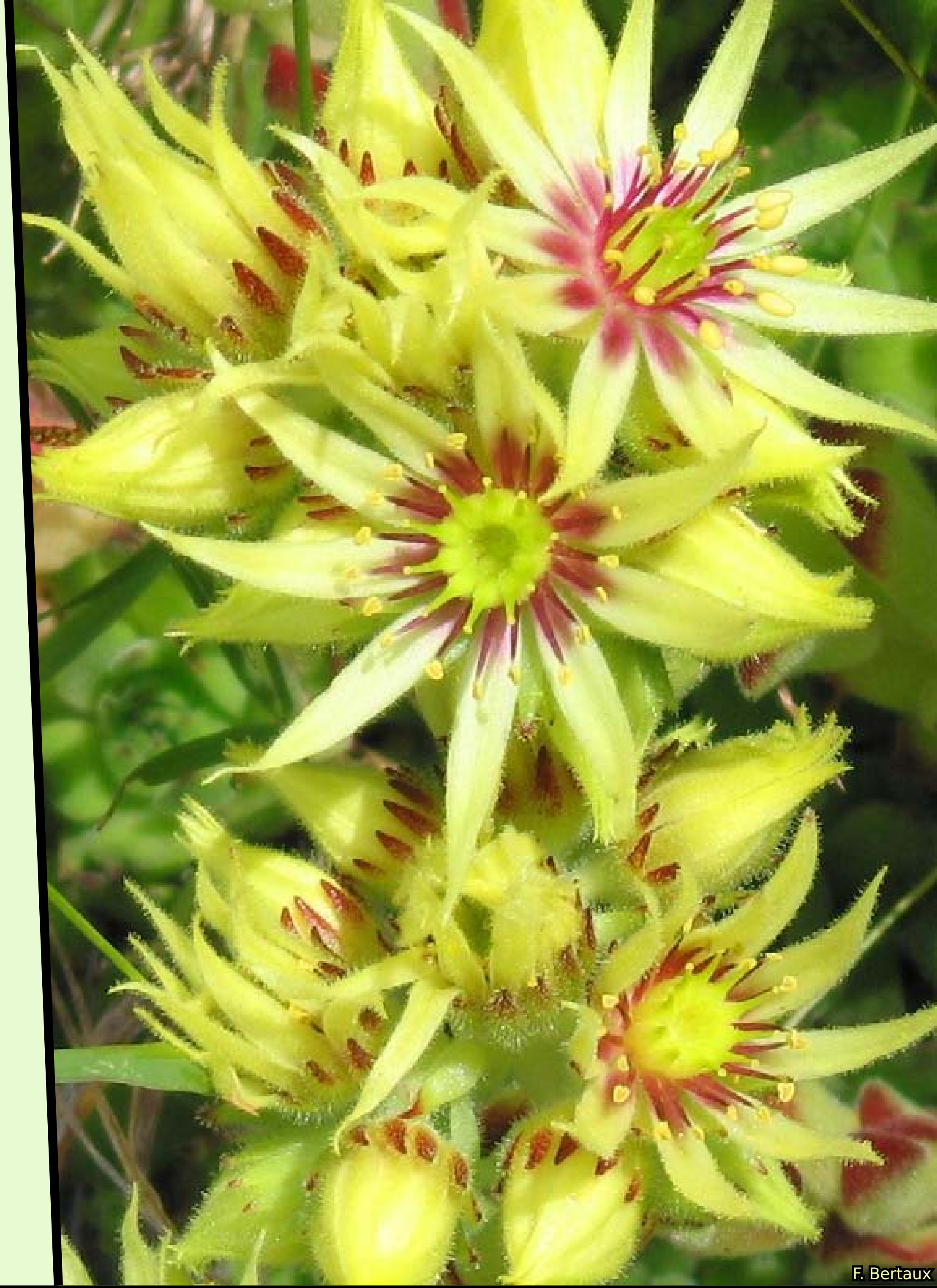
Leaves: very succulent, dark green with a well defined reddish-brown apical blotch, particularly during spring, covered on both sides by a short but dense glandular pilosity, having a very thick, glue-like secretion. This pilosity emanates a very strong, musky odour, easy to recognize but rather unpleasant and even intolerable for some people.

Inflorescence: terminal, on top of a rather short stalk; the size of the inflorescence proper is rather modest, with rarely more that 5-6 simultaneously open flowers. The stalk leaves are rather large and more or less equally sized without obvious difference between the lower and the upper ones.

Flower: generally large or very large, compared to the other houseleeks, but the diameter varies considerably, (2-) 3-4 (-5) cm; the numerous petals (about fifteen, but the number is very variable) are elongated and tapering, they are of a beautiful bright yellow, although they can be pale yellow, tending to light green sometimes, with always a purple basal blotch; the staminal filaments are of the same purple colour.

Possible confusions:

Sempervivum grandiflorum can be confused possibly with *Sempervivum montanum* L. during its vegetative stage, particularly with the subsp. *burnatii* Wettst. ex Hayek in the southern Alps and the northern Appennines, whose rosettes without flowers, larger and with wider leaves than the typical *S. montanum,* have an aspect that looks rather like *S. grandiflorum*. The confusion can occur outside the flowering period only, since the flowers of *S. montanum* are wine-red and those of *S. grandiflorum* are yellow. Eastwards, a possible confusion could occur with *Sempervivum wulfenii* Hoppe(1) during flowering time, but although both plants are rather similarly yellow-flowered, their rosettes are very different. Even though these three plants are silicicolous, they grow at different altitudes (*S. grandiflorum* occupies the mountain belt, *S. montanum* and *S. wulfenii* the sub-alpine and alpine belts). We could also mention the possibility of confusing *S. grandiflorum* with the white-yellow flowered variant of *S. montanum*: the confusion is even easier in this case, but the yellow flowered *montanum* is so rare that the probability is rather small. In reality, the most frequent confusion occurs between *S. grandiflorum* and its hybrids, in particular *Sempervivum* ×*christii* Th.Wolf, but we'll talk about that later.


F. Bertaux

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1 see: Donati D. & Dumont G. (2013), Sempervivum wulfenii, the Sun-Houseleek, in *Acta Succulenta* 1(2): 213-237

Variability and subordinate taxa

Sempervivum grandiflorum is quite a morphologically homogeneous plant in its entire distribution range. Like all houseleeks, it obviously shows a marked variability, but the internal variability of the populations are not very different from the variability shown in its entire range, so even though there are rather "morphologically peculiar" populations, these can't be recognized in a well-argued way as infraspecific taxa.

The variability observed *in situ* mainly concerns the size of the flowers, their colour and the size of the apical foliar blotch, as well as (but less evident), the rosette size and the stolon length.

Etymologically, *Sempervivum grandiflorum* means "the houseleek with big flowers", an indcation of the fact that it clearly has a larger flower compared to that of other houseleeks. In reality, this epithet is not always deserved.... Whilst the size of its flowers can be larger than those of the other species in the genus; there is much variability, depending on the geographic location and even on the individuals, to the extent that it cannot represent a true discriminating character if taken in isolation.

The same goes for the other character described as distinctive of this species (but very subjective), which is the very characteristic odour (often considered unpleasant...) that should allow us to distinguish it even when not in flower. That's true but by no means always the case. Although many of the *Sempervivum grandiflorum* clones undoubtedly stink... sorry, smell, specimens whose odour is not much stronger to that of other species of houseleeks (all houseleeks are fragrant and have the scent of... houseleek) is far from rare.

Before evaluating these characters, it's important to make sure we aren't examining one of its many natural hybrids: these are often more numerous than the "pure" species at their growing stations, and being able to distinguish them isn't always easy, due to their many and apparently easy back-crossings with *Sempervivum grandiflorum*.

Distribution

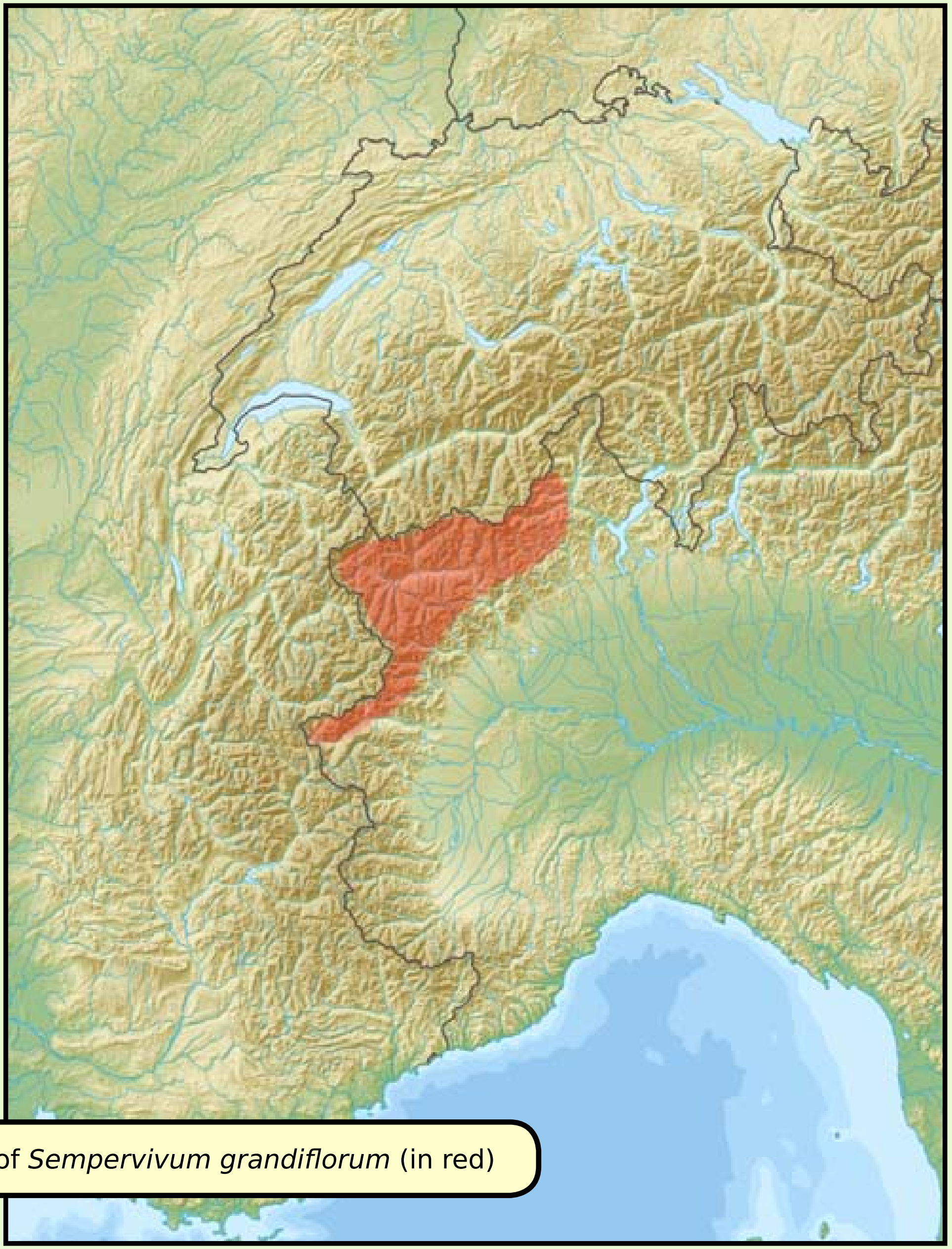
Sempervivum grandiflorum Haw. is endemic to the Italian Alps, distributed over the mountains slopes of Piemonte and Valle D'Aosta, starting from Lago Maggiore (Valle Antrona) in the east and up to the northern limit of the province of Cuneo to the south-west.

Its distribution range is homogeneous, without notable breaks, forming a sort of croissant shape that spans over the inner north-west of the Alpine mountain range.

The plants distribution is quite regular over its range, without any important gaps, except near the boundaries, where the populations are sparser and less contiguous.

Sempervivum grandiflorum can only be found on the Italian side of the Alps, never going beyond the summit ridges, and for this reason it is absent in France and Switzerland. Since it's unable to grow at high altitudes, it's unlikely that it would ever cross the Alps, considering that in this area lie the highest passes and peaks. To be honest, *S. grandiflorum* can be found in the Swiss Valais, in the Val d'Entremont, but the former presence of a botanical garden nearby casts doubts about a spontaneous presence at this locality.

However, could we hypothesize that a long time ago (before the glaciations) *Sempervivum grandiflorum* occupied the western and northern side of the Alps as well? Actually, its current distribution range, which occupies only the Italian side of the Alps, could be the remains of an ancient, pre-glacial species that was pushed to the southern foot of the Alps during the glaciations, and which then re-colonized the slopes following subsequent warming-up. We can't rule out that in ancient times this species occupied the western and northern side of the Alps, but that can't be totally excluded since in the western side the refuge-areas are mainly calcareous which would explain why it was unable to remain there during the glaciations, considering its calcifugous attitude.



Distribution of *Sempervivum grandiflorum* (in red)

Although it would seem impossible to confuse *Sempervivum grandiflorum* with any other species, even when not in flower, it's been often confused mainly with *S. wulfenii* on the eastern Alps, so much so that the literature contains many errors regarding the real limits of its distribution, particular in the east of its area.

It should be noted that this is the western-most yellow-flowered *Sempervivum sensu stricto* (*Sempervivum* subgenus *Sempervivum*, *Sempervivum globiferum* subsp. *allionii* is even more western, but it belongs to *Sempervivum* subgenus *Jovibarba*), being the red-flowered taxa predominant in the western and Caucasian regions, whilst the yellow-flowered taxa are mainly present in the Balkan and Anatolian regions. However, the yellow colour of the flower doesn't necessarily imply a direct relationship of *S. grandiflorum* with the closest Balkan taxa or *S. wulfenii* in the eastern Alps.

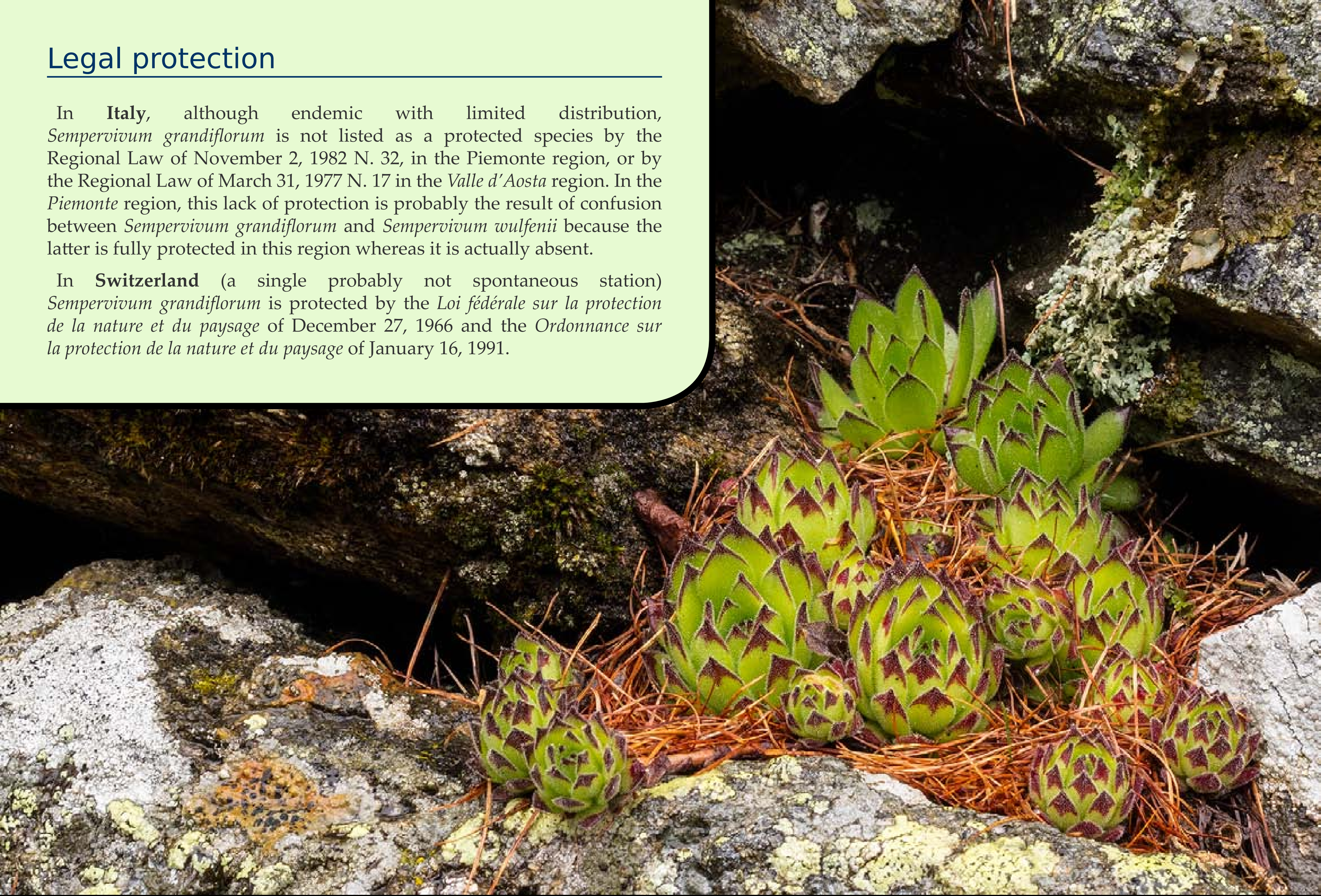
Ecology

Sempervivum grandiflorum is typically a medium-altitude plant. Regarding vegetation levels, *S. grandiflorum* is mainly present on the mountain level, absent at higher levels and very rarely descending to the hill level.

Sempervivum grandiflorum is heliophilous, as all houseleeks are, but it is also rather thermophilous compared to many other houseleeks..

Sempervivum grandiflorum is also an acidophilous species, growing in abundance on crystalline and volcanic rocks, with an acidic or neutral pH. Up to the present day, it's unknown on limestone in natural conditions, but it's difficult to ascertain whether it is purely a physiologically calcifugous plant or whether other environmental or competitive factors are playing a role on this type of rock. It's worth noting that in cultivation, *S. grandiflorum* seems to be indifferent to the type of substrate.

At the mountain level, this species can be found amongst meadow vegetation. However, it should not be forgotten that these current meadows are the result of centuries of deforestation and pastoralism. The original habitat of this plant was hence probably restricted to rocky open areas inside thick forests covering sunny slopes.



Legal protection

In **Italy**, although endemic with limited distribution, *Sempervivum grandiflorum* is not listed as a protected species by the Regional Law of November 2, 1982 N. 32, in the Piemonte region, or by the Regional Law of March 31, 1977 N. 17 in the *Valle d'Aosta* region. In the *Piemonte* region, this lack of protection is probably the result of confusion between *Sempervivum grandiflorum* and *Sempervivum wulfenii* because the latter is fully protected in this region whereas it is actually absent.

In **Switzerland** (a single probably not spontaneous station) *Sempervivum grandiflorum* is protected by the *Loi fédérale sur la protection de la nature et du paysage* of December 27, 1966 and the *Ordonnance sur la protection de la nature et du paysage* of January 16, 1991.

A bit of nomenclature

Sempervivum grandiflorum Haw. in *Revisiones Plantarum Succulentarum* : 66 (1821)

Synonymy:

= *Sempervivum gaudinii* H.Christ, in *Neue Denkschrift der Schweiz Naturf. Gesellsch*. (1867)
≡ *Sempervivum braunii* subsp. *gaudinii* (H.Christ) Vaccari
≡ *Sempervivum wulfenii* subsp. *gaudinii* (H.Christ) Nyman
= *Sempervivum grandiflorum* var. *vallesiacum* Chodat & Massey
= *Sempervivum globiferum* auct. non L. emend. J.Parn.
(= *Sempervivum luteum* Haller – nec linn. syst.)

The original diagnosis by Haworth is very short:

S. grandiflorum (great-flowered Houseleek) pubescens : stolonibus flagelliformibus : petalis sub-15-lineari-lanceolatis elongatis. *S. globiferum*, *Bot. mag*. 507 *et* 2115. *Nec Aliorum*.

This diagnosis refers to two illustrations of the *Botanical Magazine*, reproduced here, therefore two syntypes, but the first one (*Bot. Mag.* n° 507) having been published before the second one, it can be considered as the holotype for this taxon.

Prior to being described with the current epithet by Haworth, and a long time after this publication, this plant had often been called *Sempervivum globiferum* L., originally a vague and very confusing Linnean name which has been in turn attached to all the yellow flowered Eurasian species of *Sempervivum*.

Chromosome number: 2n = 80; this high chromosome number describes this plant as very likely tetraploid, as many other houseleeks are suspected of being. As of today, no diploid individual has been found, however few chromosome counts on this plant have been performed(2).

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2 Zésiger F. (1961), Recherches cytotaxonomiques sur les Joubarbes, Note préliminaire, in *Ber. Schweiz. Bot. Ges. (Bulletin de la Société Botanique de Suisse)* 71: 113-117 / Favarger C. & Zésiger F., in Tutin T.G. & al. ; *Flora Europaea*, Cambridge University Press, ed.1 (5 vol. 1964-1980) vol. 1: 352-356 (1964)

This beautiful natural hybrid is an example of the difficulty of identifying these plants with precision. The hypothesis which best explains its morphology is that of a triple hybrid of formula *S. grandiflorum × montanum x arachnoideum*.

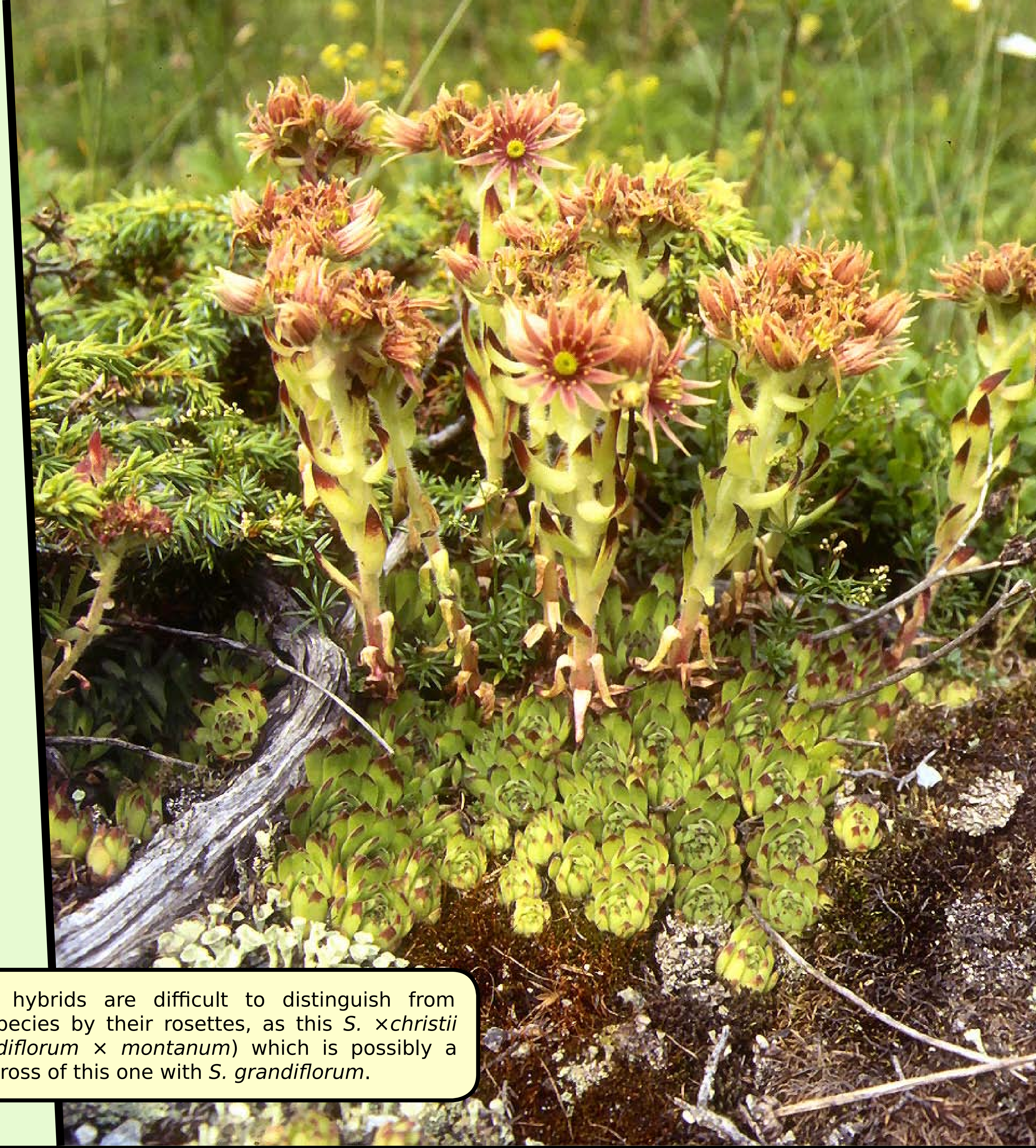
Natural hybrids

Sempervivum grandiflorum is another houseleek for which it is botanically essential to speak about hybrids, as in its natural stations, the hybrids of *S. grandiflorum* are often more numerous than the pure species itself. We can even say that in many stations *S. grandiflorum* is a rare plant compared to the abundance of its hybrids! Furthermore, from an aesthetic and cultural point of view, the natural hybrids of *S. grandiflorum* are often very beautiful plants. It's among them that, in our opinion, one can find the showiest flowers of the entire genus *Sempervivum*.

Sempervivum ×hayekii

Sempervivum grandiflorum is notable due to the ease and the frequency that it hybridizes with *all* the other houseleeks cohabiting or neighbouring with it *in situ*, i.e. *Sempervivum tectorum* L., *S. arachnoideum* L. and *S. montanum*. Only the crossing with *Sempervivum globiferum* subsp. *allionii* (Jord. & Fourr.) 't Hart & Bleij is unknown *in situ*, although these two plants cohabit at Argentera and Canavese, but *S. globiferum* belongs to the *Jovibarba* subgenus, and the hybrids between these two subgenera, when they occur, are known to be weak and low-growing plants, and consequently incapable of surviving long in natural conditions.

Since *Sempervivum grandiflorum* hybrids are generally more or less fertile, back-crossings abound between these hybrids and the various parent species, as well as the crossings between hybrids, forming *in situ* a continuum of plants that are difficult to identify, with probably less than rare triple-hybrids. So, here's the short list of direct hybrids, but the reality in the field is *much* more complicated and is enough to threaten the mental health of botanists unfamiliar with houseleeks including even those who have been "chewing" houseleeks for a long time...



Many hybrids are difficult to distinguish from the species by their rosettes, as this *S.* ×*christii* (*grandiflorum* × *montanum*) which is possibly a backcross of this one with *S. grandiflorum*.

Sempervivum ×christii Th.Wolf
(*S. grandiflorum* × *montanum*)

Sempervivum ×christii Th.Wolf, Notice sur quelques plantes nouvelles ou rares pour le Valais, in *Bulletin des Travaux de la Société Murithienne (Société valaisanne des Sciences Naturelles)*, Sion, fasc. 16-18, «1887-89» : 29 (1890)

Sempervivum ×christii is a very frequently occuring hybrid and is constant where the species cohabit or are in close contact. It's worth noting that *S. grandiflorum* presents its maximum frequency at lower altitudes than those where *S. montanum* flourish, so that *S. ×christii* often represents a link between the levels occupied by the two species, becoming the predominant or even the only species growing in some intermediate places and thus establishing a morphological and altitudinal pseudo-continuum between its two parent species.

Although intermediate between the two parent species, the aspect of this hybrid frequently reminds one more of *Sempervivum grandiflorum* than of *S. montanum* (a small, pilo-glandular species with a short stalk and large, wine-red flowers). Outside the flowering period, confusion between *S. ×christii* and a small-sized *S. grandiflorum* is quite possible and even frequent. The flower colour of this hybrid is rather variable, classically intermediate between the parent species, and thus yellowish-beige; specimens with pink flowers, or on the contrary, very pale flowers are frequent though. The distinction between *S. ×christii* and the possible white flowered forms of *S. grandiflorum* (likely back-crossings of this hybrid with *S. grandiflorum*) can be really complicated.

Sempervivum ×christii

Sempervivum ×hayekii G.D.Rowley (*S. grandiflorum × tectorum*)

Sempervivum ×hayekii G.D.Rowley in H.Jacobsen & G.D.Rowley, Some name changes in succulent plants Part IV, in *National Cactus & Succulent Journal*, 13(4): 76 (1958)

Sempervivum ×hayekii is also a constant and abundant hybrid wherever the two species cohabit, frequently and especially on rocky meadows.

Sempervivum ×hayekii is easily recognizable even outside the flowering period, since its vegetative morphology is exactly intermediate between the parents, and the possibility to confuse it with them is unlikely. It's a nice, vigorous plant, with fantastic large flowers (often larger than the parent species) with shining petals which are pale yellowish-pink or whitish.

Sempervivum ×hayekii

Sempervivum ×vaccarii

Sempervivum ×vaccarii Vaccari (*S. arachnoideum × grandiflorum*)

Sempervivum ×vaccarii Vaccari, Il Sempervivum gaudini e la sua distribuzione nelle Alpi, in *Annali di Botanica di Roma*, Prof. Pirotta, 3(2): 39 (1905)

Sempervivum ×vaccarii Wilczeck in Wilczeck, Vaccari L. & Maillefer, Contribution à la flore valdôtaine, in *Bull. Soc. Bot. Ital*. (1903) [nom. nud.]

Sempervivum ×vaccarii is a very frequent and constant hybrid wherever its parents cohabit, although not the most frequent hybrid of *Sempervivum grandiflorum in situ*, certainly less frequent than the two hybrids above. Its aspect is relatively intermediate between the two parent species, often with very well coloured rosettes.

It should be noted that the name of this hybrid is attributed either to Wilczeck or to Vaccari himself. In reality this auto-dedication isn't due to the author's immodesty, the latter has simply added a valid description to a *nomen nudum* by Wilczek dedicated to Vaccari himself. Thus, it would be much clearer (but nomenclaturally incorrect...) to write *Sempervivum ×vaccarii* (Wilczeck) Vaccari.

Sempervivum ×alidae Hort. ex Zonn. (*S. grandiflorum × wulfenii*)

Sempervivum ×alidae Hort. ex Zonn., The missing hybrid Sempervivum ×alidae, in *British Cactus and Succulent. Journal* 4(3): 65 (1986)

We have already written about this hybrid in the article regarding *Sempervivum wulfenii*(3).

Does this hybrid exist in Nature? Probably not. However, since the answer isn't 100% certain, it would have been important to find an answer to this question BEFORE burdening the nomenclature with a misleading botanical epithet that could give an impression that these species cohabit or are in proximity, a fact that is still unproven.

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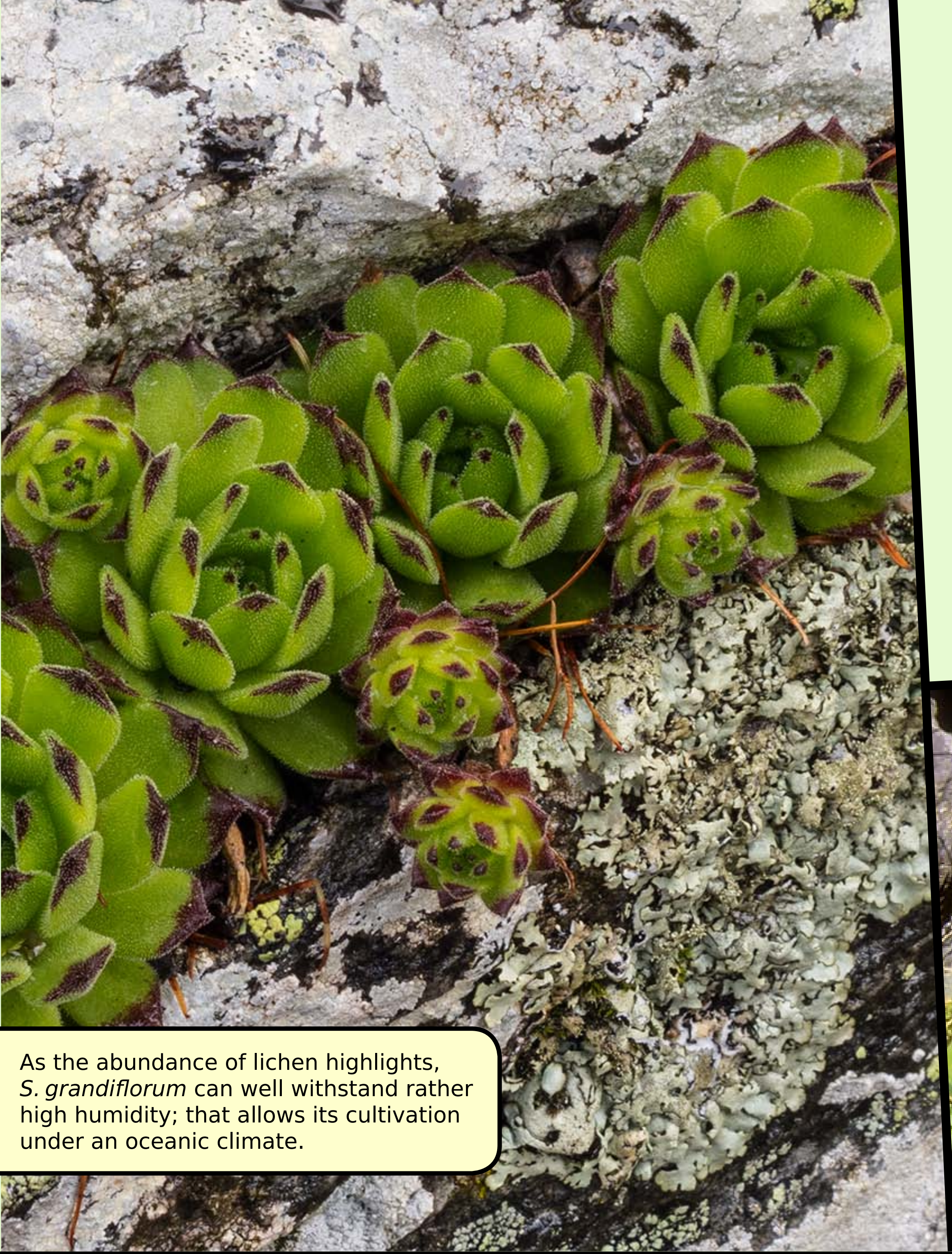
3 Donati D. & Dumont G. (2013), Sempervivum wulfenii, the Sun-Houseleek, in *Acta Succulenta* 1(2): 213-237.



As the abundance of lichen highlights, *S. grandiflorum* can well withstand rather high humidity; that allows its cultivation under an oceanic climate.

Cultivation notes

Sempervivum grandiflorum is a very beautiful houseleek. That would be a sufficient reason to cultivate it, especially since it's also an easy to grow houseleek.

Sempervivum grandiflorum presents very few problems since it can withstand winter humidity better than many other houseleeks, however, and this is relative, it's always advisable to protect it from water during autumn and winter. As with all houseleeks, outdoor cultivation during good weather is mandatory.

Like many houseleeks, it doesn't like very hot summer temperatures, although it fares better than many other species (i.e. much better than *S. wulfenii*, another yellow-flowered houseleek that we spoke about recently). An east or north-east exposure is thus recommended in areas with hot weather.

Sempervivum grandiflorum is perfectly frost hardy, but only if it doesn't show any sign of etiolation.

A well drained, but sufficiently rich soil, with some humus added, and regular feeding will transform *Sempervivum grandiflorum* or its hybrids into veritable jewels, especially when in flower. Whilst for many houseleeks flowering is almost a problem in cultivation, since the flowers aren't particularly interesting and leave horrible gaps in the clumps (the rosettes are all monocarpic), *S. grandiflorum* and its hybrids are an exception, and one waits impatiently for it!

In cultivation, *Sempervivum grandiflorum* often forms scarcely compact clumps, that expand well beyond the pot: in order to make the plant look more compact, it's possible to repot some of the external rosettes into the gaps.

Propagation

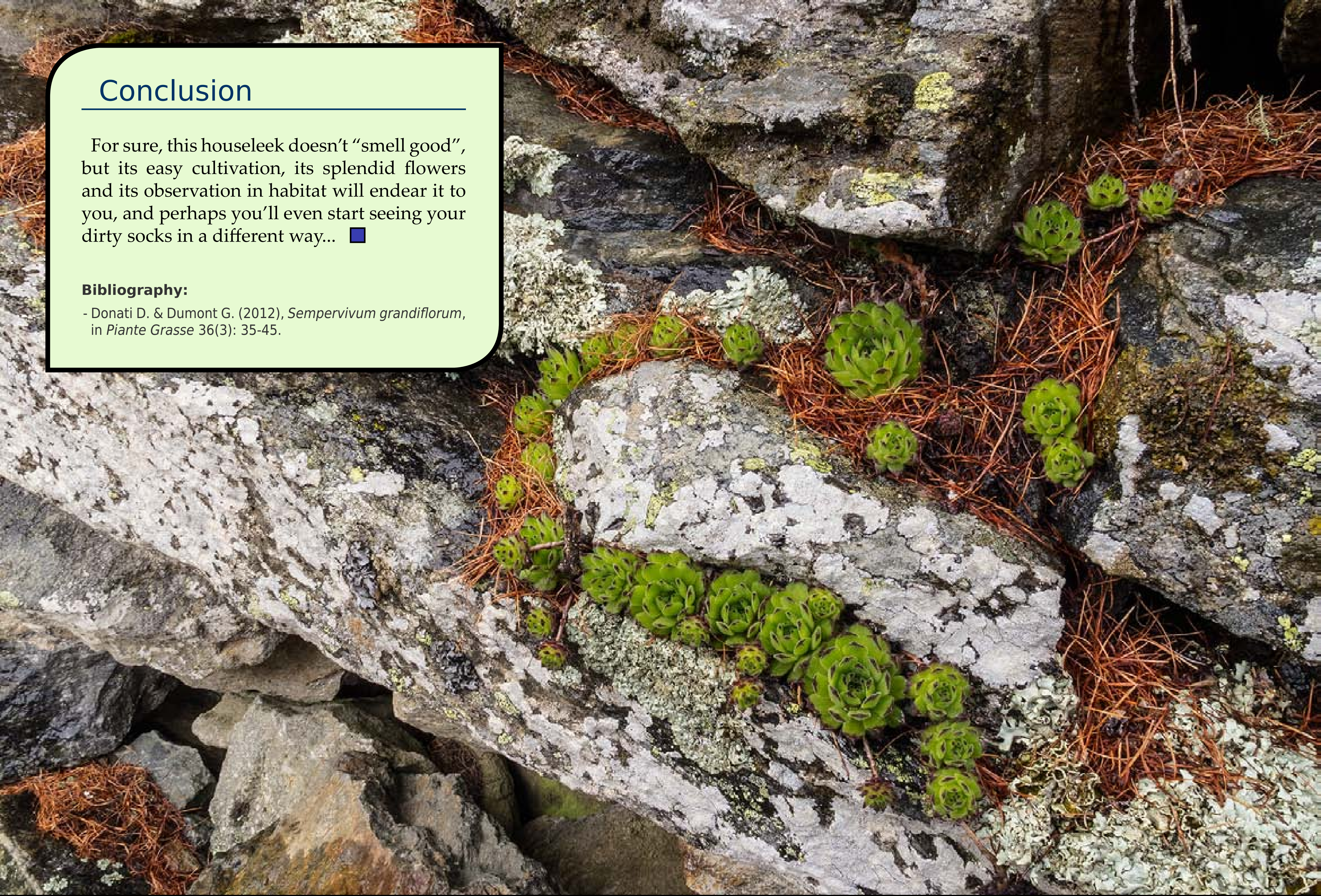
As with almost every houseleek, repotting the lateral rosettes is the easiest way. *Sempervivum grandiflorum* isn't very prolific, but grows fast enough to easily distribute this nice plant to other enthusiasts.

Sowing is very easy but uncommon, since, as already mentioned, *Sempervivum grandiflorum* easily crosses with other species, and even seed collecting in habitat can result in some unexpected surprises. The identity of seed from other collections will be far from certain and can usually contain anything and everything...

Where and how to get *Sempervivum grandiflorum* ?

Sempervivum grandiflorum can be found in most nurseries catalogues of hardy succulents and Alpine plants, albeit rarely with locality data. Some of its hybrids are also available on the market, but their ID is far from sure... However, a "*S. grandiflorum* ×" ID is much better than a random nothospecies ID, considering the difficulty in recognizing the genealogy of some hybrids. In spite of that, the latter are outstanding plants in cultivation.

As invariably happens with houseleeks, exchange between amateur growers is the easiest and most reliable way to obtain properly identified plants with known origin.



Conclusion

For sure, this houseleek doesn't "smell good", but its easy cultivation, its splendid flowers and its observation in habitat will endear it to you, and perhaps you'll even start seeing your dirty socks in a different way...

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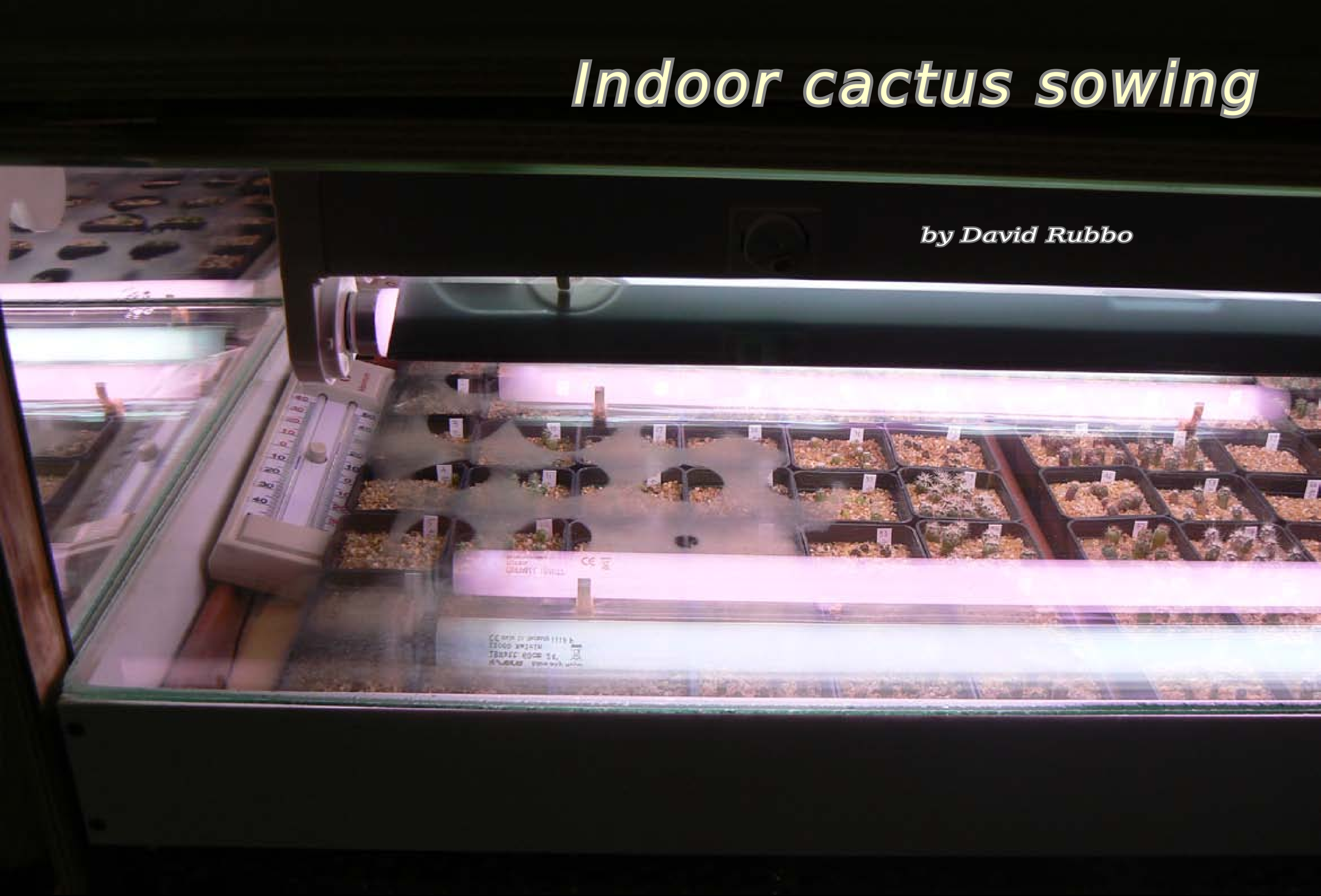
Indoor cactus sowing

by David Rubbo



I have been sowing cactus seeds since 1991. About ten years ago, while visiting some friends, I saw that it was possible to sow cactus seeds by using a seed propagator or germinator. Then in 2005, my experiments and passion began.

In the wild, probably very few seedlings manage to survive and reach adulthood, due to the tough selection imposed by natural factors. But in cultivation, it's quite possible and even a duty, in my opinion, to reduce losses, considering that we don't have hundreds of seeds available. My goal is to get the most out of even a few seeds (with locality data if possible) and obtain the maximum number of strong and healthy plants..

The advantages of a seed propagator

Using a seed propagator can give you many advantages. If you think about it, sowing under artificial conditions allows you to study and control the environmental variables, mainly light and heat:

- you can anticipate the sowing period, rather than wait for Spring, when it would be possible to sow under natural conditions.
- you won't be at the mercy of the weather, when, for example, periods of cold or rain could adversely affect the seedlings.
- by maintaining optimal conditions during and after sowing, the seedlings, which are very delicate at the beginning of their life, will enjoy a regular growth rate.

I don't like to complicate simple things. I have avoided electronic devices in favour of electromechanical ones, since I think they are more reliable. So, no electronic units. Furthermore, I tried to simplify my interventions and their frequency, so the system has a degree of automation after sowing. Sometimes my other occupations don't allow me to perform daily checks, so I tried to avoid them without endangering the entire process. If I can't do it more frequently, 2-3 weekly inspections are enough to keep the seedlings healthy.

Echinomastus, three-month old seedlings

The frame

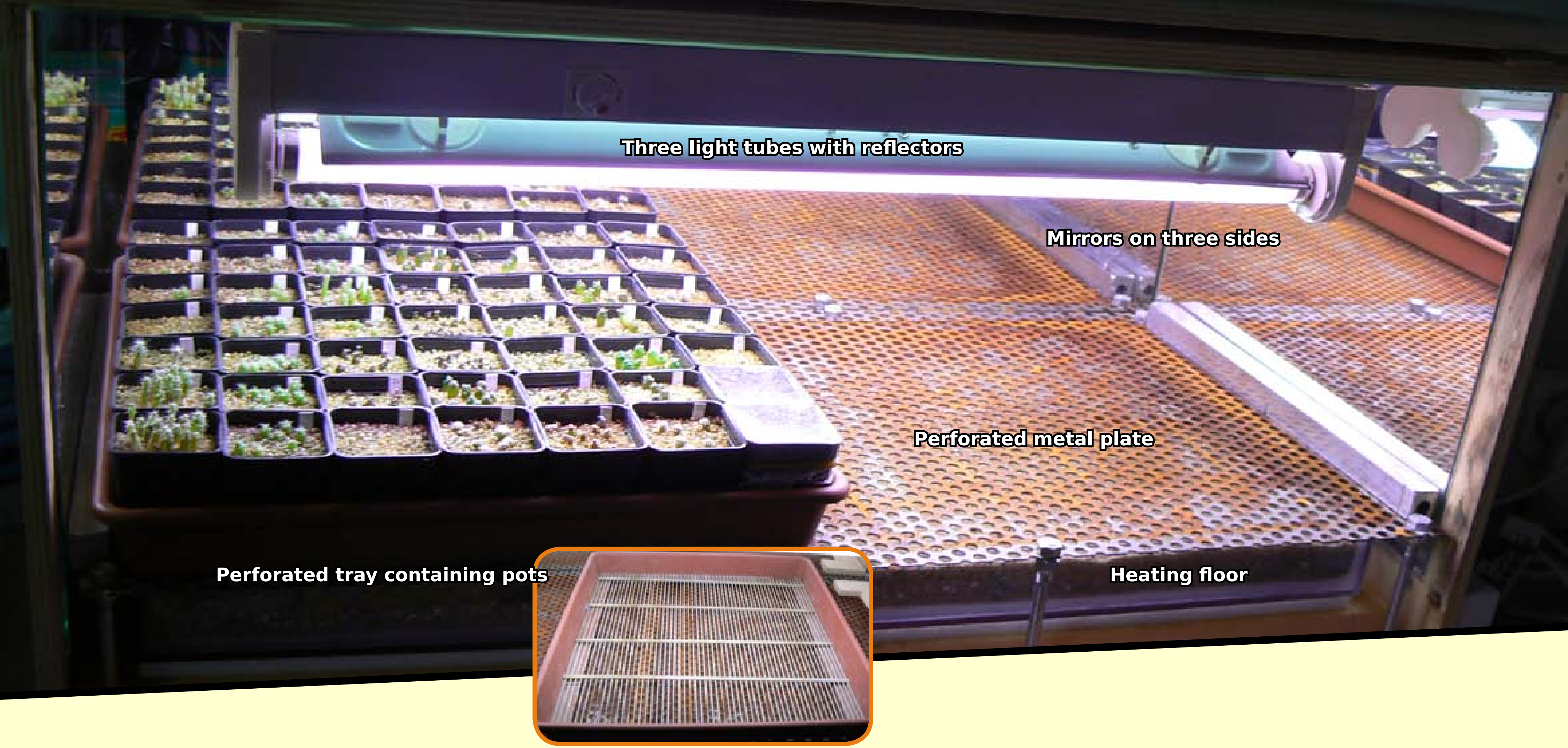
I built my first propagator by copying from the one my friends were using, and added some improvements over time.

It's a sort of wooden box with lights and heating. Considering that a device like this probably doesn't exist on the market, building a perfectly working propagator doesn't require more than a minimum of do-it-yourself capability.

I built a box 80 cm long, 40 cm wide and 40 cm high, using plywood that can be easily found in do-it-yourself stores. I used 12 mm thick wood, a good compromise I think, between lightness and robustness. Although it could be possible to build larger frames, personally I haven't tried it, since I suspect there could be problems obtaining proper air circulation. On the front side I have set up an access door, and made some holes near the bottom and the top on each side, in order to get some natural air circulation without having to resort to fans and/or air extractors.

Functioning propagator; at right side, the lighting controller.

For heating I have laid on a tray on the bottom two 50w aquarium heating cables which I covered with coarse sand. The temperature is regulated by a mechanical thermostat.



On top of that I put a sturdy plastic sheet with many holes, to support the perforated trays that contain the pots.

I lined all the parts above the support surface with cut-to-size mirrors, glued to the sides and on the top. A similar result could be achieved by using white paint or white adhesive sheets that are sold for coating the inside of furniture, or adhesive sheets specific for indoor growing that would undoubtedly make a lighter structure.

For lighting I'm using 3 fluorescent tubes 60 cm long, a good compromise with the propagator's size, in my opinion. Form experience I can say that increasing the number of tubes doesn't necessarily yield any better results.

Light

After some tests I have set the artificial daylength to 13-14 hours, controlled by an electromechanical timer. In the market there are a multitude of lights, starting from phyto stimulating lights up to aquarium lights, the choice is endless. After several attempts and having spent quite a bit of money in not entirely satisfactory lighting, for various reasons, I have found a combination that works well at last.

An article I found on the Internet has been of great help. It was dealing with the type of light needed for growth of algae: my goal was exactly the opposite, trying to reduce or eliminate their growth, since this is certainly not desirable for indoor sowing. The article said that growth of algae is stimulated by a specific light wavelength, the 530 nm green. I narrowed the search to those lamps whose spectrum excluded this particular wavelength, which substantially reduced the choice, since there aren't many phytostimulating lights with this characteristic.

In my experience, *Osram Fluora®* and *Sera Blue Sky Royal®* have proved the best. I have 3 tubes 60 cm long, fitted with reflectors to increase light output. I start the sowing process with 2 lateral *Osram Fluora®* and 1 central *Sera Blue Sky Royal®*, and probably this is the right choice for the entire indoor period. However, when the seedlings reach a certain size, more or less after 2 months, I reverse the arrangement, with 2 lateral *Sera Blue Sky Royal®* and 1 central *Osram Fluora®*; which results in an increase in the fraction of blue light which seems to benefits the growth of the young seedlings. Moreover, by using light devoid of the 530nm green radiation, algal growth is drastically reduced, and so is the risk of rot and the need for fungicidal treatments.

Since the light output between a source and the lit object varies with the inverse square of the distance between them, we can easily understand why it's very useful to position the lights as close as possible to the pots, since even small differences greatly increase the yield. In my propagator, after several attempts, the distance between the lower side of the tubes and the pots is 11-12 cm. It works in my context obviously, and shouldn't be taken as an absolute value.

In the propagator, 2½ months after sowing

Pseudolithos, three-month old seedlings

Heat

Effective heating underneath the pots improves roots' health and reduces the risk of rot. You can find a lot of information, contradictory sometimes, regarding the optimal temperatures. When I was sowing under natural light and temperature, empirically the right period started when the minimum temperature was constantly above 10°C. About the maximum temperature, it's well known that temperatures above 30°C can cause a slow down/stop of growth, in many plants, even non-succulent ones. In my experience, I'm sure that minimum temperatures above 15-18°C lead to an important reduction of the germination rate, at least in the species I sow, mainly North-American *Cactaceae*, whilst very high temperatures, above 30°C, can inhibit seedlings' growth. So in my experience, the optimal temperatures range between 10-12°C night minimum and about 28°C day maximum.

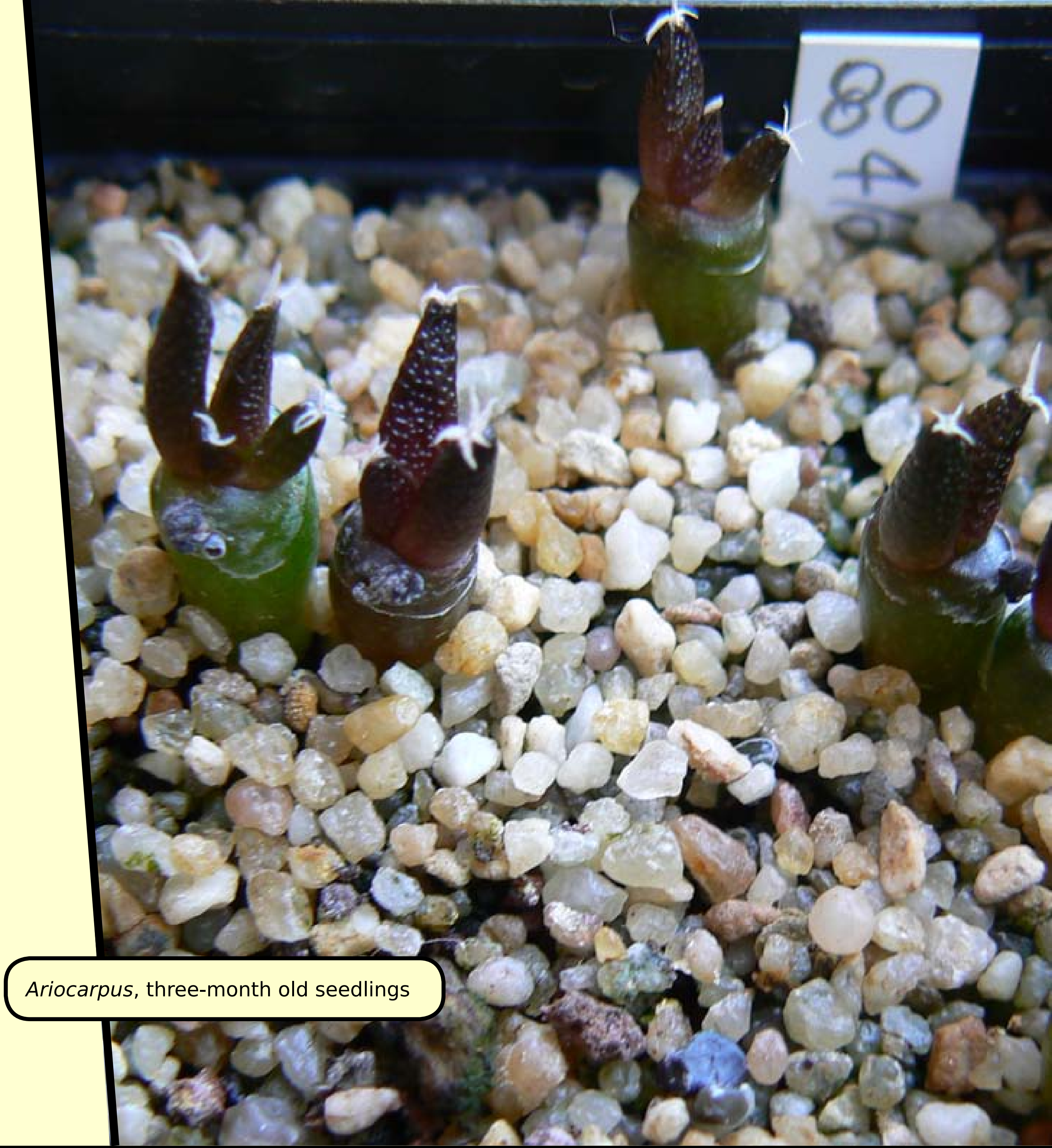
You could argue that some succulents require higher temperatures, and I must admit that I don't have much experience with them, but I have sown *Pseudolithos* and *Whitesloanea* with the same conditions, and, despite the fact that they originate from warmer areas, particularly the minimum temperatures, I have been able to grow them successfully.

Ventilation

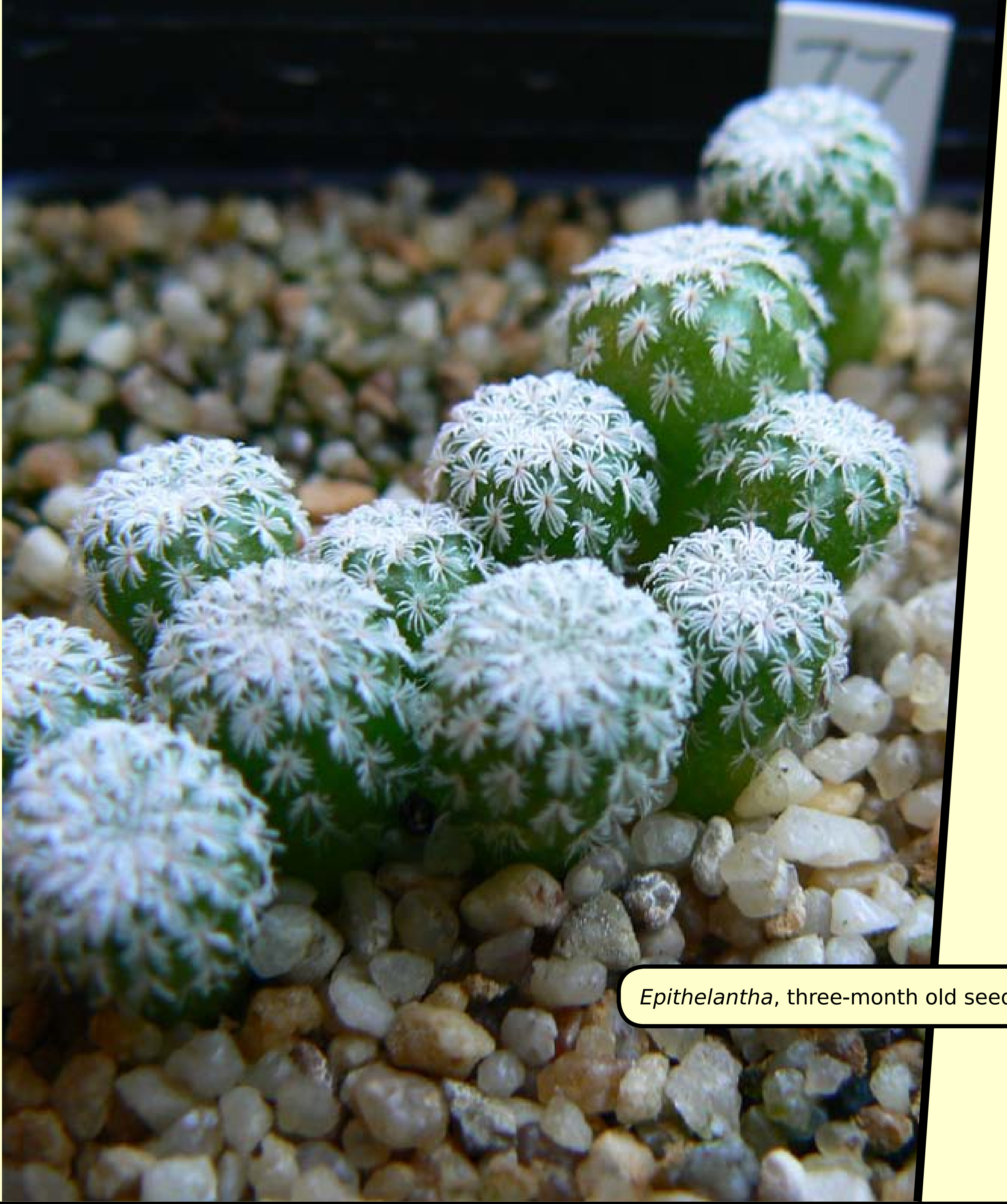
You'll very often see propagators equipped with fans or air extractors to move the air. I tried to use some at the beginning, but I removed them very soon after. They were unnecessary and even harmful, in my conditions at least. I seal my pots initially and then I put a panel of glass over them, so there's no possibility of moving the humid air with my method. Fans could be used if the pots are kept uncovered, a choice that I have almost immediately discarded for several reasons:

- If the soil surface layer dries up quickly, it becomes necessary to sprinkle very often, otherwise the seedlings dehydrate easily and stop growing or even die.
- Due to the continuous alternation between wet and dry, a superficial crust forms that can lift up when drying and break the thin roots, which is very likely detrimental to the seedlings.

In summary, to undertake a constant work for a modest result seems totally pointless to me. I chose a solution where the air exchange is rather limited, provided just by holes in the lateral sides of the frame, near the top and bottom. By heating the bottom an ascending flow of warm air would naturally occur, and this is sufficient for my needs. If the seedlings rot, this is not necessarily exclusively from a lack of ventilation, and it's always good to investigate other reasons.



Ariocarpus, three-month old seedlings



Epithelantha, three-month old seedlings

Soil

Personally I disagree with those that use very poor soil. I made a test once by sowing exclusively in lava gravel, and I got stunted seedlings. That was an experience that I haven't repeated. In the vast majority of cases I use fertile soil, with 30-40% peat, about 10% quartz, and the rest lava and pumice. Peat isn't always the same, and I use quality peat, the one used to sow vegetables in sowing trays which I believe is free or almost free of fungal spores. It is fine-grained with a pH of 6-6,5, which I then sift, discarding all particles larger than 3 mm. By using poor quality peat in large quantities, the risk of rot is very high. I sift the volcanic material and quartz as well, discarding dust and particles larger than 3 mm.

If one wants to avoid or reduce the quantity of peat, it would probably be useful to try with alternate materials, such as sandstone or some type of field soil, in order to avoid a mix exclusively made with loose material, where the roots can find little foothold and don't develop well.

Pots

I use square pots, from 5 to 7 cm in size. These allow you to save space and to get the maximum benefit from the heat coming from below if positioned contiguously. If non-adjacent pots are used, heating is almost useless, since much of the heat is lost between pots.

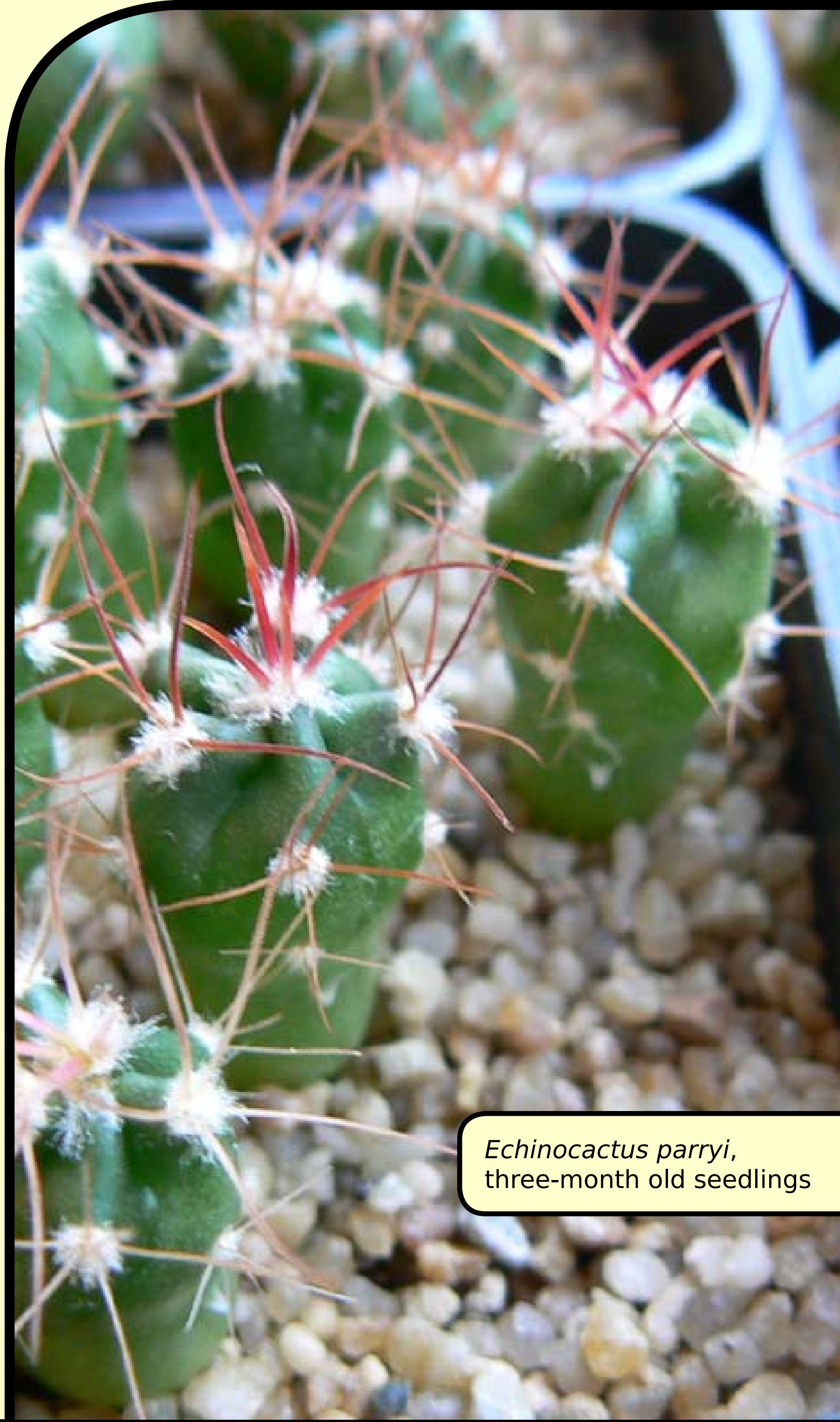
I use clean pots, new or cleaned with diluted bleach, in order to prevent rot caused by the presence of fungal spores on dirty pots.

Watering

I use rain or demineralized water. The advantage of using salt-free water is that it doesn't form deposits or crusts that can lift and break the seedlings delicate roots. Also it avoids nutritional deficiencies caused by water hardness. I use lukewarm water in order to avoid thermal shocks to the roots. I boil a small quantity of water in the microwave oven and then I mix it with cold water. I water by immersion, every 8 days on average. A simple way to determine when to water is to remove the superficial soil with a toothpick and water when it's dry.

Feeding and other treatments

I start fertilizing when the first small spines appear, usually about two and a half months after sowing. I use cactus fertilizer at a very low concentration, 0.1-0.2 grams per litre of water and this I repeat monthly during the first year. Since algae are virtually absent, I have never had problems with sciarid flies or other parasites, so I don't use pesticides. Fungicidal treatments are reduced to the very minimum, about twice during the first year.



Echinocactus parryi, three-month old seedlings

How I proceed in practice, from A to Z

I prepare the pots with the soil:

- On the bottom, I put a thin layer of coarse quartz, with 1 cm or less particle size. I use quartz instead of pumice or other porous materials since it definitely holds less moisture, not being hygroscopic.

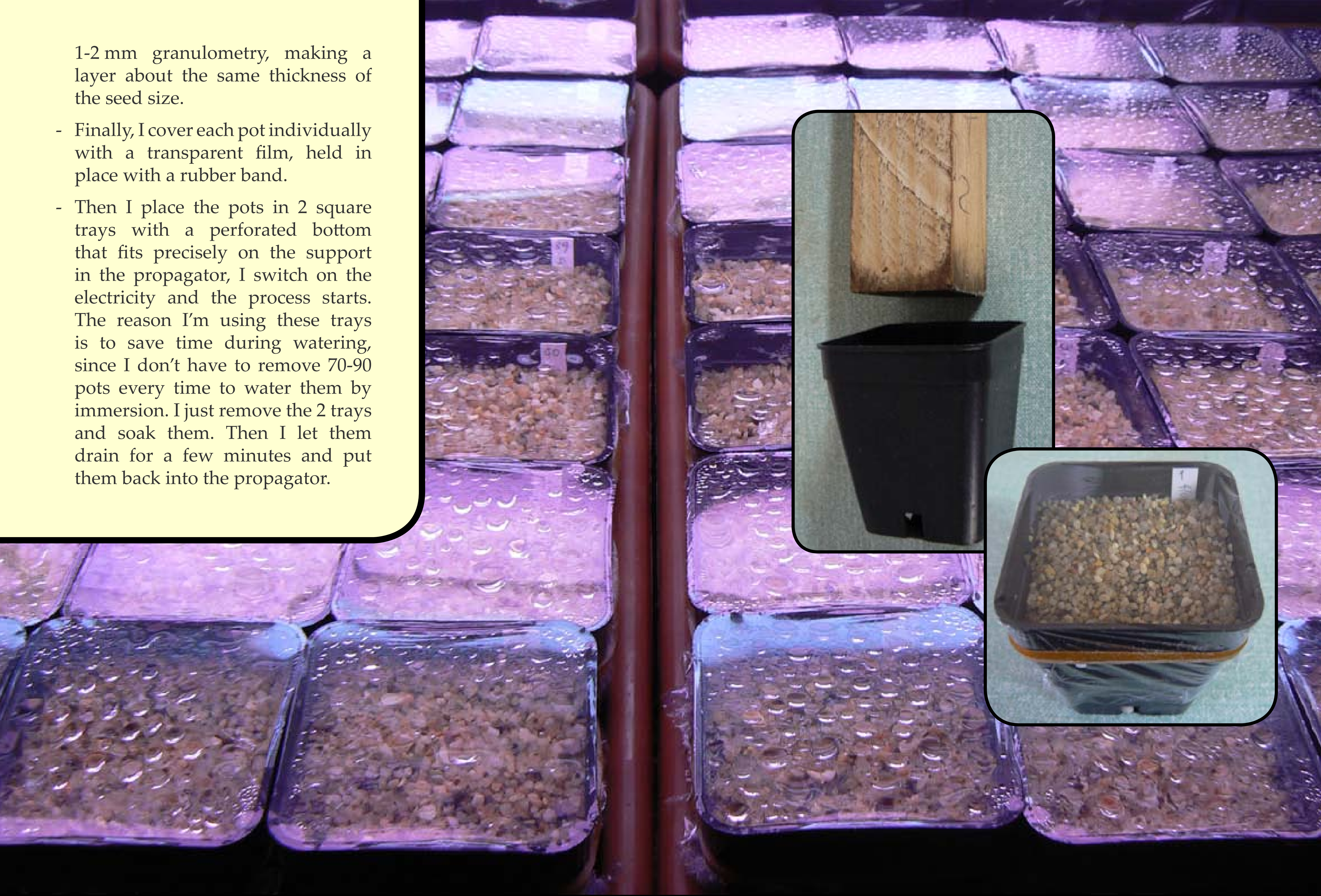
- I fill the pots with soil up to about 1 cm from the edge, pressing down lightly. I prepare all the pots and then put a number of them in a saucer that fits precisely on the microwave plate.

- I put the saucer in the microwave, add water up to half the height of the soil, maybe a bit more, so that the soil becomes completely soaked by capillary action and switch it to maximum power for 9-10 minutes. It's possible to add a specific fungicide for sowings. The purpose of this operation is to sterilize the soil.

- I remove the pots and leave them to dry, covered in order to avoid contamination from above, and after at least 8-10 hours I sow the seeds. I prefer to sow sparsely since I have noticed better growth when there are fewer seedlings in a pot than when there are many. Usually I put 10-12 seeds in a pot. I cover the seeds with light coloured quartz for aquariums with

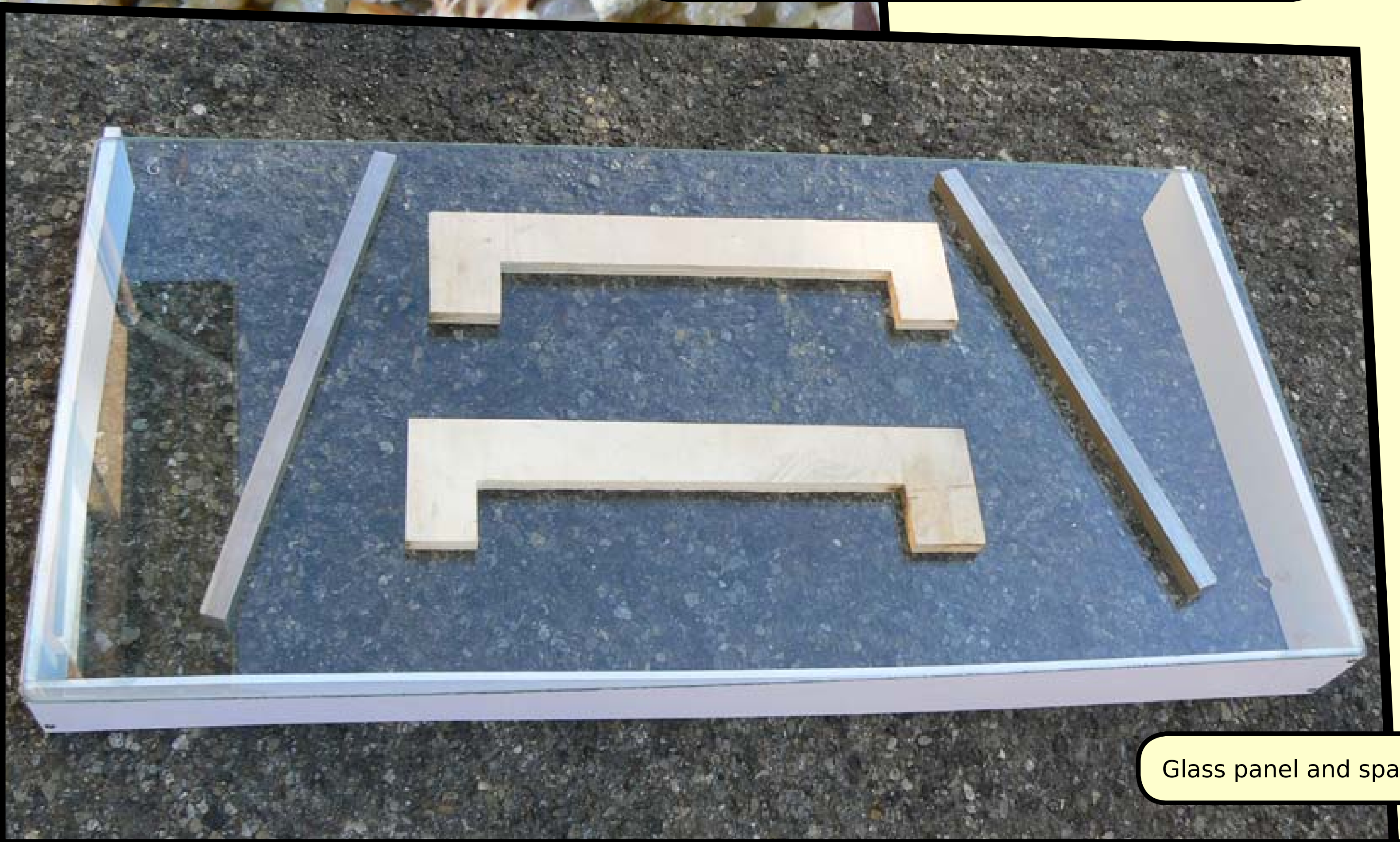
1-2 mm granulometry, making a layer about the same thickness of the seed size.

- Finally, I cover each pot individually with a transparent film, held in place with a rubber band.
- Then I place the pots in 2 square trays with a perforated bottom that fits precisely on the support in the propagator, I switch on the electricity and the process starts. The reason I'm using these trays is to save time during watering, since I don't have to remove 70-90 pots every time to water them by immersion. I just remove the 2 trays and soak them. Then I let them drain for a few minutes and put them back into the propagator.



- I leave the cellophane covering the pots for 3-4 weeks before removing it completely. After removing it, I put a glass panel a few centimetres above the pots and add a profile closing 3 sides in order to reduce heat loss.
- Over time, I gradually raise the panel, adding spacers underneath; in order to give more air to the seedlings, and add a profile closing 3 sides in order to reduce heat loss.

Echinomastus intertextus, one-month old seedlings



Glass panel and spacer-supports

- I only remove the glass panel completely when it's time to take the pots out of the propagator. The seedlings will stay in the propagator until the end of May at least. They could be taken out earlier, but an environment with controlled light and heat will benefit them, allowing for better and steadier growth, even if they never see sunlight. With a properly functioning propagator, artificial light should be an advantage.

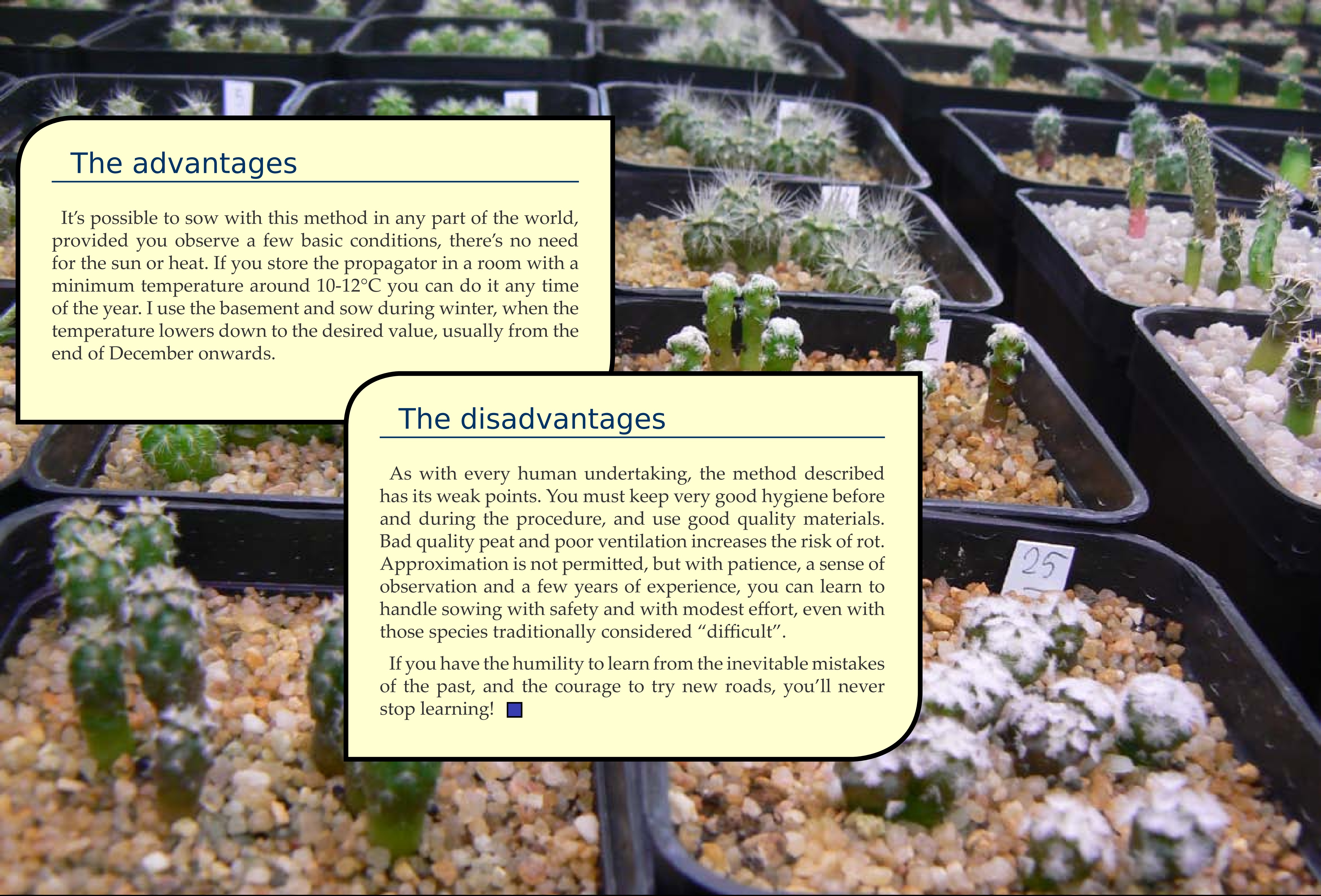
Some possible precautions

For those seedling with an elongated shape which start pushing underneath the cellophane very shortly after germination, I make a sort of wire frame that lifts the cover thus preventing contact with the seedlings. Or for very rot-sensitive species, in addition to the frame described above, it's possible to punch little apical holes in the cellophane to reduce stagnant moisture. The same operation performed on a flat cover would have no effect on humidity.

For those species with a thin neck that could be their weak point if left uncovered (i.e. *Sclerocactus* and the like) , I add coarse quartz, when they are about two months old, and fill the pots up to the edge; this could greatly help their survival, especially later.

Supporting frame for cellophane.

Some 6x6 pots filled up to the edge with quartz – 2½ months after sowing.



The advantages

It’s possible to sow with this method in any part of the world, provided you observe a few basic conditions, there’s no need for the sun or heat. If you store the propagator in a room with a minimum temperature around 10-12°C you can do it any time of the year. I use the basement and sow during winter, when the temperature lowers down to the desired value, usually from the end of December onwards.

The disadvantages

As with every human undertaking, the method described has its weak points. You must keep very good hygiene before and during the procedure, and use good quality materials. Bad quality peat and poor ventilation increases the risk of rot. Approximation is not permitted, but with patience, a sense of observation and a few years of experience, you can learn to handle sowing with safety and with modest effort, even with those species traditionally considered “difficult”.

If you have the humility to learn from the inevitable mistakes of the past, and the courage to try new roads, you’ll never stop learning! ■

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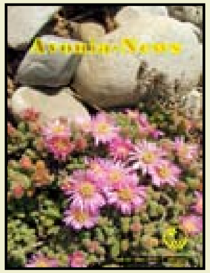

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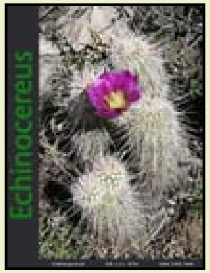

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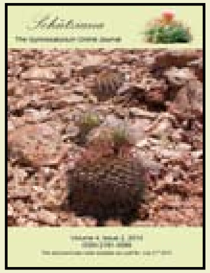

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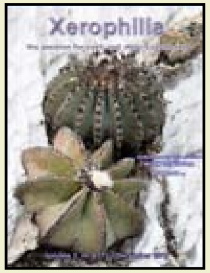

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