LICHENS

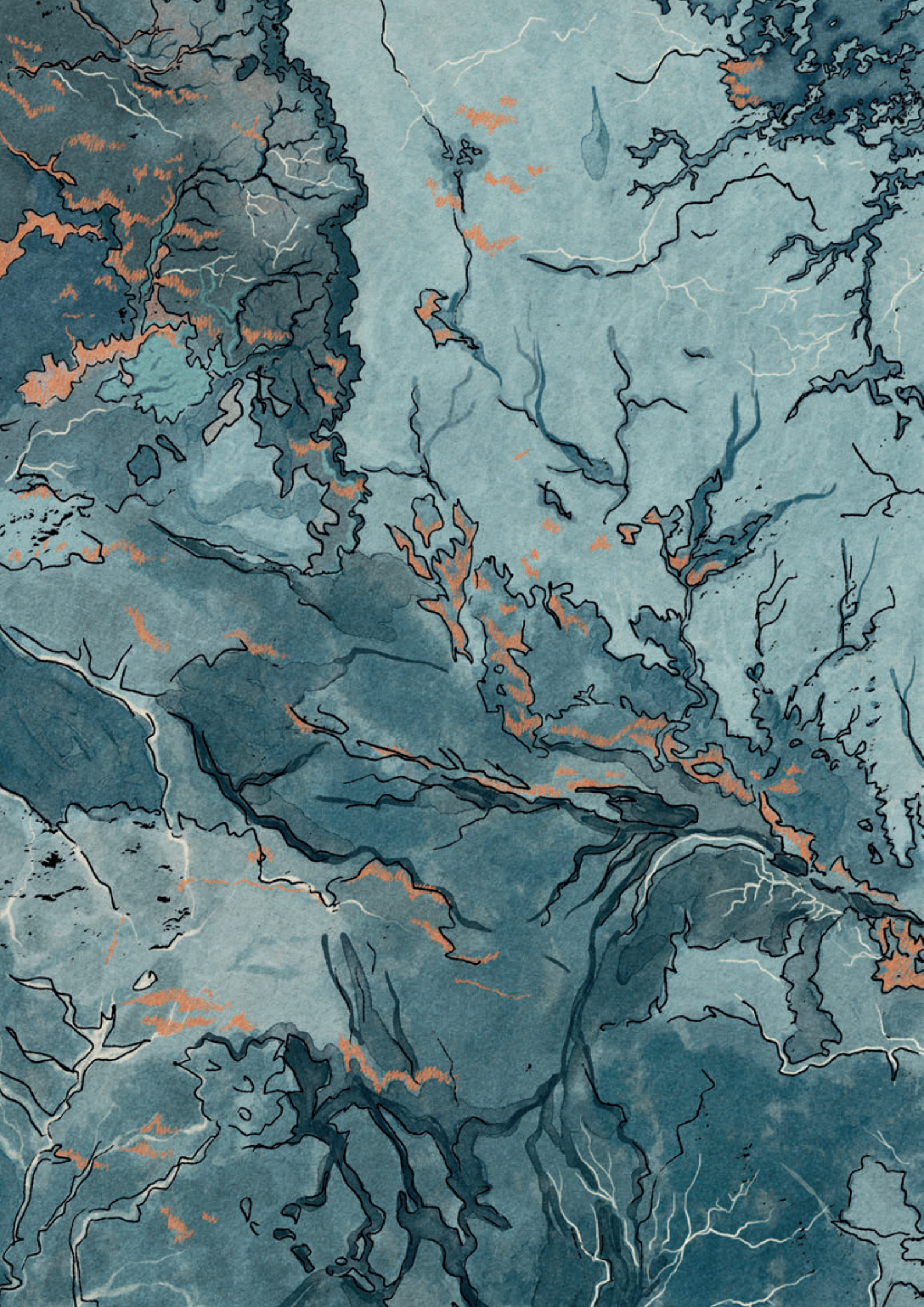
ATLAS

AlUla & Khaybar White Volcano

VOLUME I

AFALULA
FRENCH AGENCY FOR ALULA DEVELOPMENT

الهيئة الملكية لمحافظة العلا
ROYAL COMMISSION FOR ALULA



ATLAS

AlUla & Khaybar White Volcano

VOLUME I

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LICHENS ATLAS
ABOUT THE PROJECT:

This atlas is the visible result of a substantial biodiversity and conservation research effort supported by the Royal Commission for AlUla, under the framework of Vision 2030. It was produced within the project "**Inventory of Lichens in AlUla and Khaybar White Volcano**", which focuses on documenting and understanding the lichen diversity of two regions of remarkable ecological and geological significance. The project was motivated by a clear gap in our knowledge of these often-overlooked organisms in the Arabian Peninsula. Despite the absence of specific lichen studies in the region, the unique climatic and ecological conditions of AlUla and the Khaybar White Volcano suggested that they could host rich and previously undocumented lichen communities. Ongoing research is proving this to be true: provisional data indicate the **presence of over 100 lichen species, many of them new records for the region.**

Lichens, **symbiotic organisms composed of fungi and algae or cyanobacteria**, are frequently ignored in biodiversity assessments, even though they play crucial ecological roles such as stabilising soil, cycling nutrients, and providing food and shelter for other organisms. In arid and semi-arid regions, such as those found in Saudi Arabia, lichens exhibit remarkable adaptability and resilience, often thriving where few other organisms can survive. Their importance extends beyond ecology: lichens have been used throughout history in traditional dyes and medicines, and today they are studied for their roles in bioindication (monitoring air quality and environmental change) and biodeterioration (as agents impacting cultural heritage sites and materials). **The driving purpose of this atlas is to reveal the hidden diversity of lichens in these extraordinary landscapes and to spark curiosity, appreciation, and care. We hope each reader becomes not only an observer but an advocate for the fragile ecosystems lichens quietly support.**

A CALL TO ACTION!

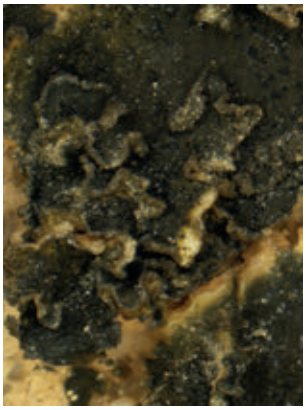
Lichens are extremely slow-growing organisms, sometimes taking decades to form visible colonies. Yet they **play vital roles in desert and arid ecosystems**: stabilizing soil, preventing erosion, enabling nutrient cycling, and serving as indicators of environmental health. Unfortunately, they face growing threats from habitat disturbance, pollution, and unregulated collecting. We encourage all readers to protect lichen-rich areas by avoiding walking on stable muddy surfaces or rock faces where lichens thrive, avoiding off-road driving, and to think carefully before collecting any specimens. If you do collect for educational or research purposes, take only what is necessary and return any unused material to its original place – lichens can often recover if gently replaced. Because of their small size and fine detail, we strongly recommend using a hand lens when observing lichens in the field. By paying attention to these subtle, resilient life forms, we not only protect an essential part of our ecosystems but also open our eyes to **the richness of life that flourishes in even the harshest of landscapes**.

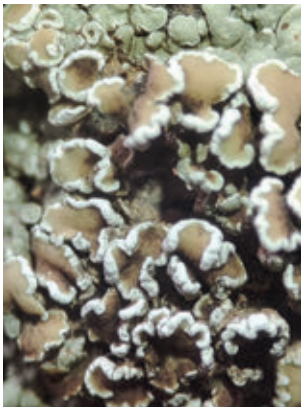
LICHENS
ATLAS INDEX

HOW TO USE THE ATLAS:

This first volume of the **Lichen Atlas includes 20 individual species**, featuring some of the most common and visually striking lichens found in the **AlUla and Khaybar White Volcano areas**. These species were selected from over a hundred currently recorded in the region. Lichens are often difficult to identify with the naked eye, but we hope the combination of carefully selected photographs, detailed scientific illustrations, notes on substrate and habitat preference, as well as current distribution information, will help readers explore this fascinating micro world. Once you start looking closely, you'll **discover a universe of textures, shapes, and colours** that are often overlooked.

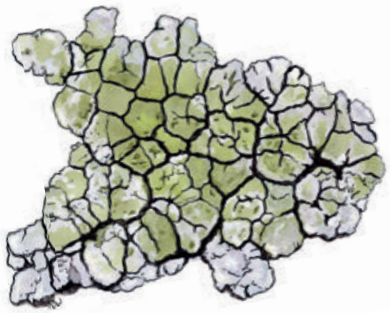
Prepare yourself to be amazed!





LICHENS
ATLAS GLOSARY

Lichens are commonly classified into three primary groups based on their morphology: **Crustose, Foliose** and **Fruticose**. An additional type, common on deserts is **Squamulose**.



Crustose

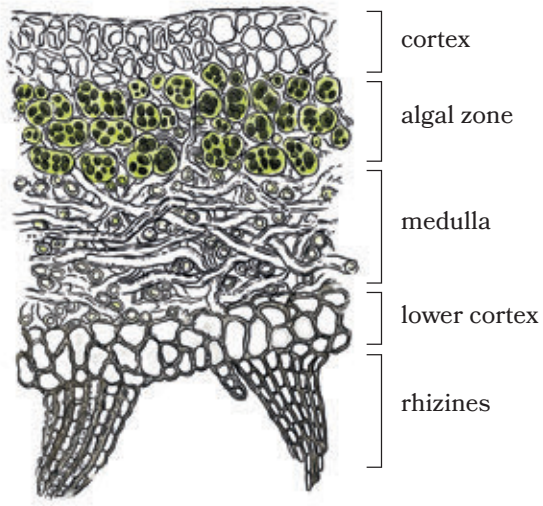
Fruticose

Squamulose

Foliose

Variations in lichen thallus anatomy, often only visible in thin sections under a microscope, are crucial for accurate **lichen identification**. A general model of the lichen thallus includes several distinct layers.

The **upper cortex** forms a protective outer layer. Beneath it lies the algal layer, where photosynthesis occurs, thanks to the presence of **algal or cyanobacterial cells**. Below this is the **medulla**, made up of loosely arranged fungal hyphae. The **lower cortex**, when present, provides additional protection, and from it extend **rhizines**, which anchor the thallus to the substrate.



GROWTH FORM

Crustose thin, crust-like lichens that are tightly attached or even partially embedded in the surface; they cannot be removed without damaging the substrate.

Foliose leaf-like lichens with lobes; loosely attached and often lifted at the edges.

Fruticose shrubby or hair-like lichens that grow upright or hang freely; attached to the substrate at a single point; in arid environments, they are usually microfruticose - small and compact due to harsh conditions.

Leprose powdery or dust-like lichens without clear structure; often spread across surfaces in irregular patches.

Squamulose made up of small, overlapping scales (squamules); intermediate between crustose and foliose forms.

ANATOMY

Algal layer the green or blue-green layer where photosynthesis happens; made of microscopic, mostly unicellular, algae or cyanobacteria.

Apothecia (sing. apothecium) disk- or cup-shaped fruiting bodies where fungal spores are produced.

Areoles small, angular surface patches that make up the thallus of many crustose lichens.

Cortex the protective outer skin of the lichen, found on the top (and sometimes bottom) of the thallus.

Hyphae thread-like microscopic filaments that make up the fungal part of the lichen.

Isidia (sing. isidium) tiny finger or wart-like outgrowths on the lichen surface, each covered by a cortex (unlike soredia); they break off easily and serve as vegetative reproductive structures.

Perithecia (sing. perithecium): embedded, flask-shaped fruiting bodies that release spores through a small pore seen as a black dot on the thallus surface.

Lobes rounded extensions or "arms" of foliose lichens, often leaf-like in appearance.

Medulla the inner, loosely packed layer of fungal hyphae beneath the algal layer, often containing air spaces and crystals of lichen substances.

Pruina a powdery or frosty coating on the surface of some lichens, often giving a pale white or bluish tint.

Rhizines root-like structures on the underside of foliose lichens, used for anchoring.

Soredia (sing. soredium) tiny powdery vegetative reproductive structures containing both fungal hyphae and algal cells; dispersed by wind or water to form new lichens (see also isidia).

Thallus the main body of the lichen, made of both fungal and algal components.

Trentepohlia a genus of filamentous green algae (Chlorophyta) found as the photosynthetic partner in some lichens; it is distinctive for its orange or pinkish colour, caused by carotenoid pigments that often mask the green chlorophyll.

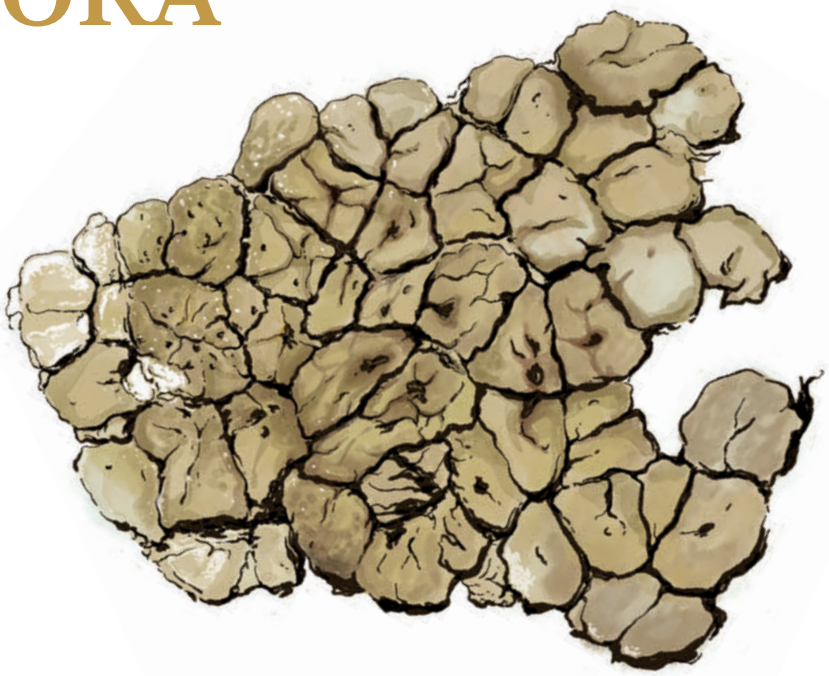
ROCK TYPE

Igneous rocks formed from cooled lava or magma (e.g., basalt, granite); often hard and mineral-rich. An example is the basalt of Harrat Uwayrid; these rocks tend to have small minerals, whereas igneous rocks in the south have large crystals; igneous rocks usually erode into large, angular shapes.

Metamorphic originally igneous or sedimentary rocks that have changed form and mineral composition under heat and pressure (e.g., marble, schist); layers in metamorphic rocks can be crumpled or folded.

Sedimentary rocks formed from compressed sediments (e.g., sandstone, limestone); layers and grains can be clearly seen; some sedimentary rocks, like limestone, are made of calcium carbonate and may resemble igneous or metamorphic rocks (however, limestone often has visible layers and well-preserved fossils).

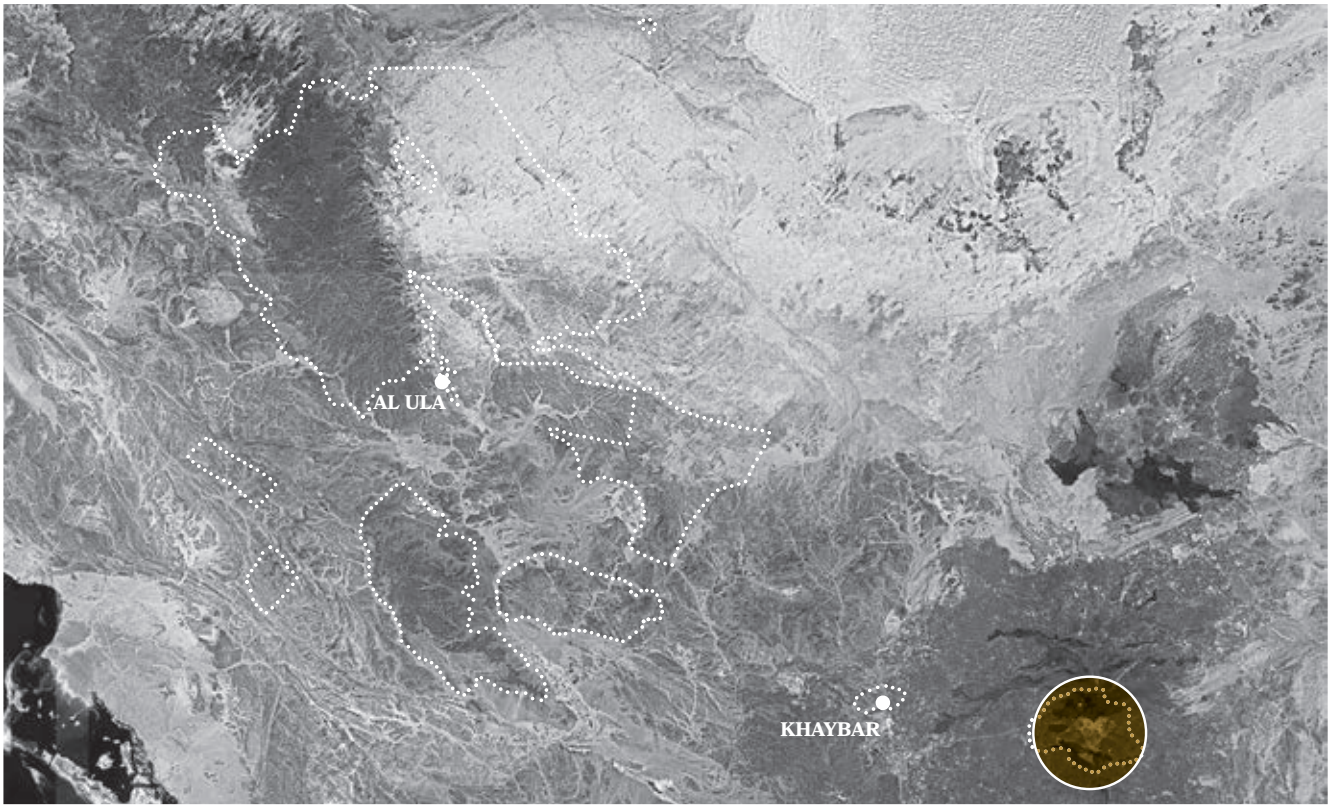
ACAROSPORA FUSCATA



Acarospora Fuscata
(Schrad.) Arnold

Description: This **crustose** lichen grows in flat, contiguous patches composed of angular, pale to dark brown areoles. The areoles often have thick, slightly raised margins and may lift slightly from the rock surface. When dry, the thallus appears polished or varnished, and it typically darkens when moist. Each areole may contain one or more tiny reddish-brown apothecia, sometimes barely visible to the naked eye.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

ACAROSPORA FUSCATA

(Schrad.) Arnold

Family:
Acarosporaceae

Habitat:
Large boulders of igneous rock found on the inclined slopes of volcanic and mountain landscapes.

Substrate preference:
Saxicolous

Growth form:
Crustose

Photobiont:
Green algae other than Trentepohlia

Reproductive strategy:
Sexual, via apothecia

Commonness-rarity in the region (CRI (1-5)):

☐ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the angular, pale brown areoles, each with several embedded reddish apothecia.

Microhabitat: Hard, vertical surfaces on angular boulders.

It often goes unnoticed unless examined closely, as its colour blends almost perfectly with the underlying rock. When wet, the surface may turn dark green, and small reddish apothecia can be seen embedded within the thallus.

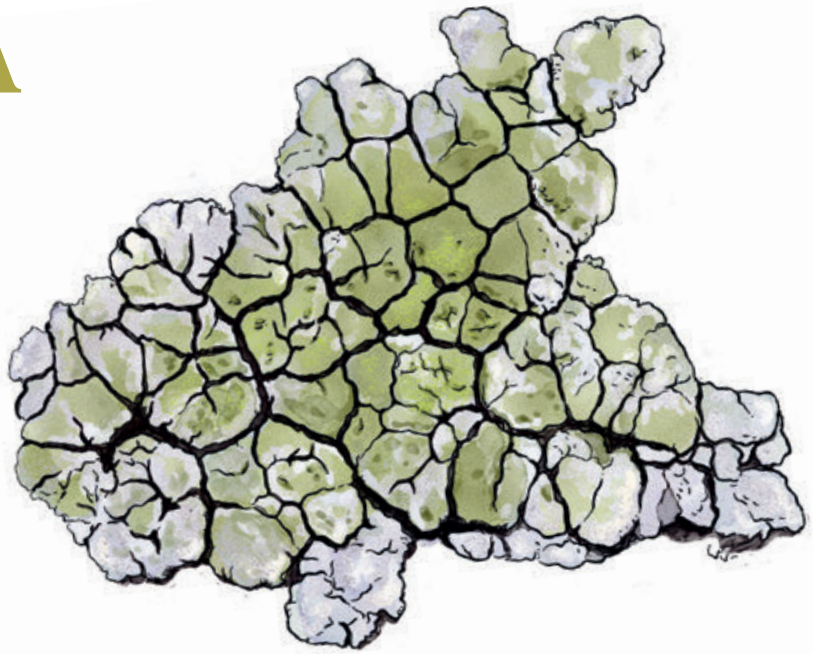
Field notes:

Acarospora fuscata general view:

Sometimes called the “cobblestone lichen”, it forms neat, glossy varnish-like patches that resemble paving stones on rock surfaces.

Acarospora fuscata detail of areoles:

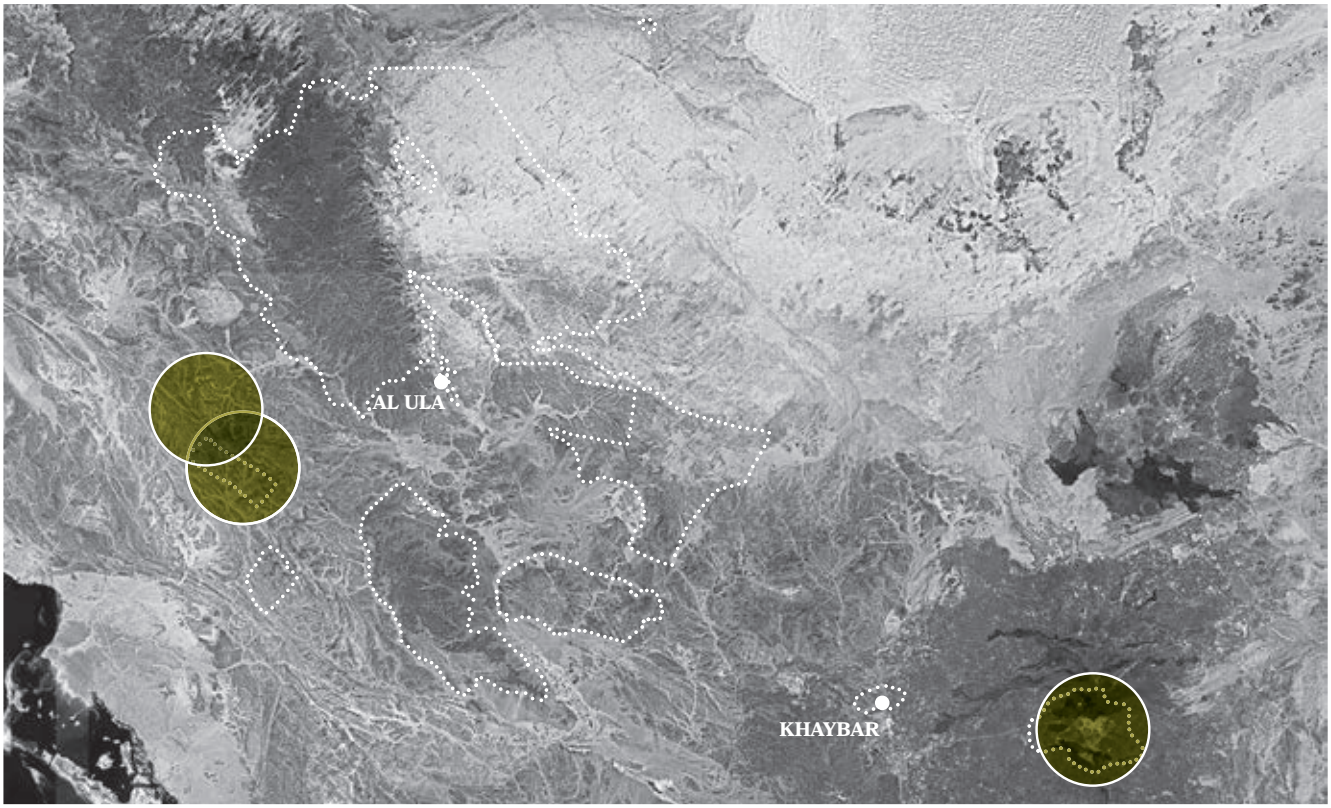
ACAROSPORA LAVICOLA



Acarospora Lavicola
J. Steiner

Description: This **crustose** lichen forms small, tightly packed patches made of angular "tiles" or areoles, which may range from whitish to pale or sulphur yellow. The thallus is smooth or slightly rough and often blends with the volcanic rock on which it grows. Exceptionally tolerant, it can withstand extreme heat, drought, and intense sun exposure, making it well-suited to arid volcanic landscapes.

Occurrence in AlUla and Khaybar White Volcano



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ACAROSPORA LAVICOLA

J. Steiner

Family:
Acarosporaceae

Habitat:
Large boulders of igneous rock found on the inclined slopes of volcanic and mountain landscapes.

Substrate preference:
Saxicolous

Growth form:
Crustose

Photobiont:
Green algae other than Trentepohlia

Reproductive strategy:
Sexual, via immersed apothecia

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | **3 - Uncommon** | 4 - Common | 5 - Very common

☑ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the angular areoles closely attached to the lava stone, sulphur yellow to pale whitish in colour due to a thin pruina layer that sometimes covers their surface.

Microhabitat: Hard, vertical surfaces on angular boulders.

Acarospora lavicola typically grows on hard, acidic rocks such as basalt and granite, and is often found on surfaces exposed to both rain and full sunlight. Its extreme habitat and subtle features make it an expert of survival on barren hard volcanic rocks like basalt.

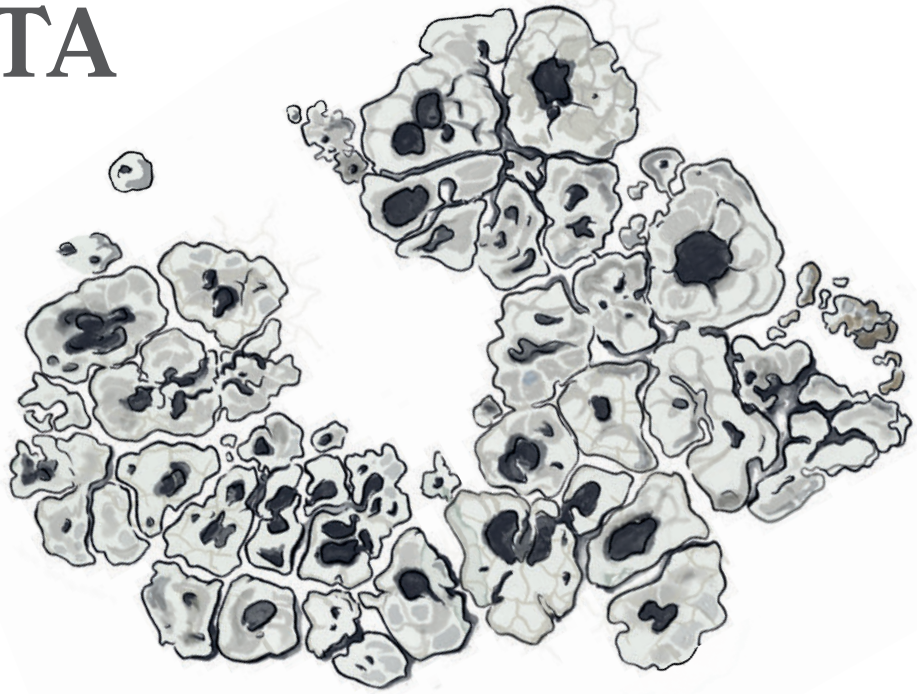
Field notes:

Acarospora lavicola general view:

Its name means “lava-dweller” – this tough little lichen brings spots of vibrant yellow to hard volcanic rocks where almost nothing else grows.

Acarospora lavicola detail of thallus parasitized by another, still unknown Acarospora species:

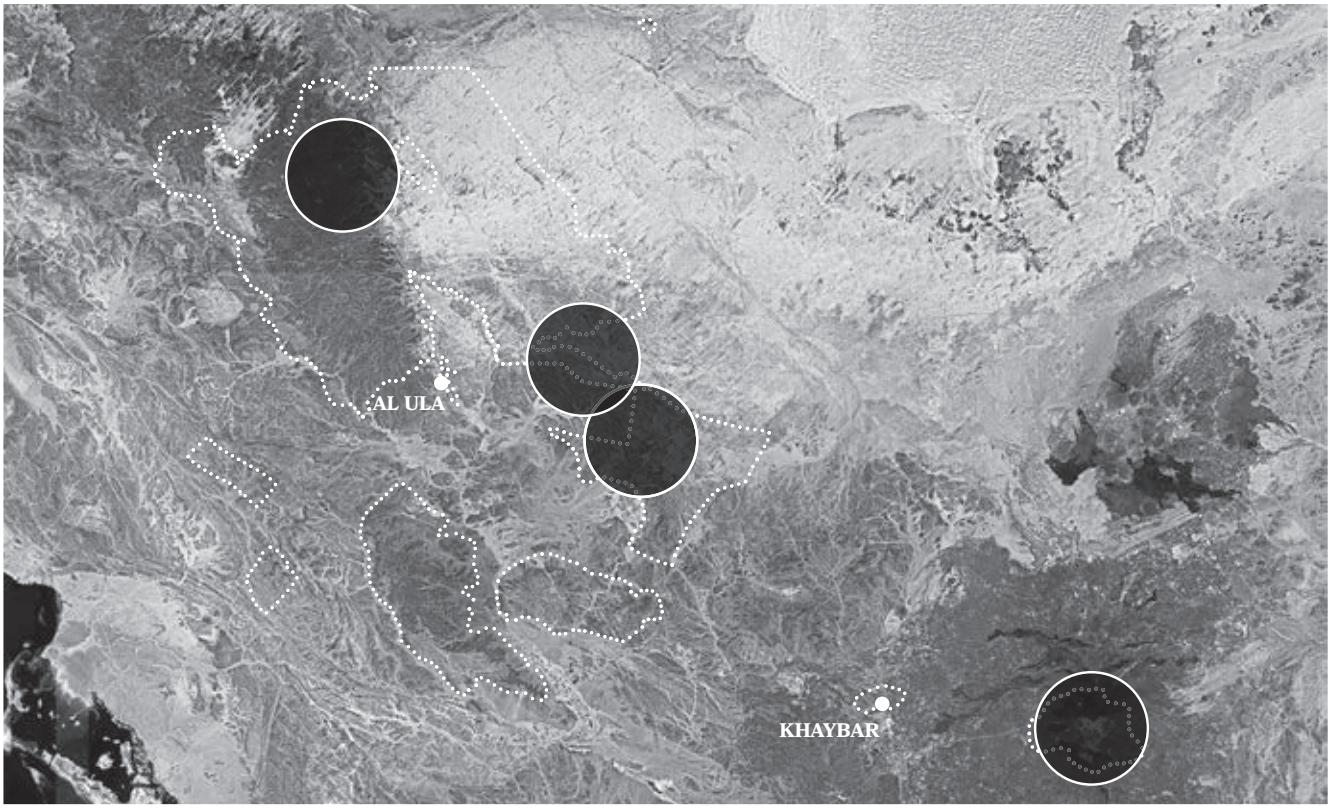
ACAROSPORA STRIGATA



Acarospora Strigata
(Nyl.) Jatta

Description: This **crustose** lichen forms small, flat patches of closely packed "tiles" (called areoles), with deeply cracked surfaces that give it a rugged appearance. The upper surface is usually white to bluish-grey due to a powdery coating (pruina), and turns brown when wet. Dark fruiting bodies (apothecia) sit embedded in the centre of each areole.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

ACAROSPORA STRIGATA

(Nyl.) Jatta

Family:
Acarosporaceae

Habitat:
Rock surfaces of sedimentary and metamorphic formations on the inclined slopes of mesas and plateaus.

Substrate preference:
Saxicolous

Growth form:
Crustose

Photobiont:
Green algae other than Trentepohlia

Reproductive strategy:
Sexual, via embeded apothecia

Commonness-rarity in the region (CRI (1-5)):

☑ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the deep fissures around each small areole and the dark apothecia nestled inside, with the white surface coating that masks its brown interior.

Microhabitat: Soft, horizontal to slightly inclined rock surfaces with rounded edges.

It grows in exposed rocky environments and tolerates high temperatures and sunlight. Its rough, cracked texture is especially noticeable in dry climates, where it contributes to the patchwork of life on rock surfaces. Although subtle in appearance, it plays a quiet but important role in desert ecology.

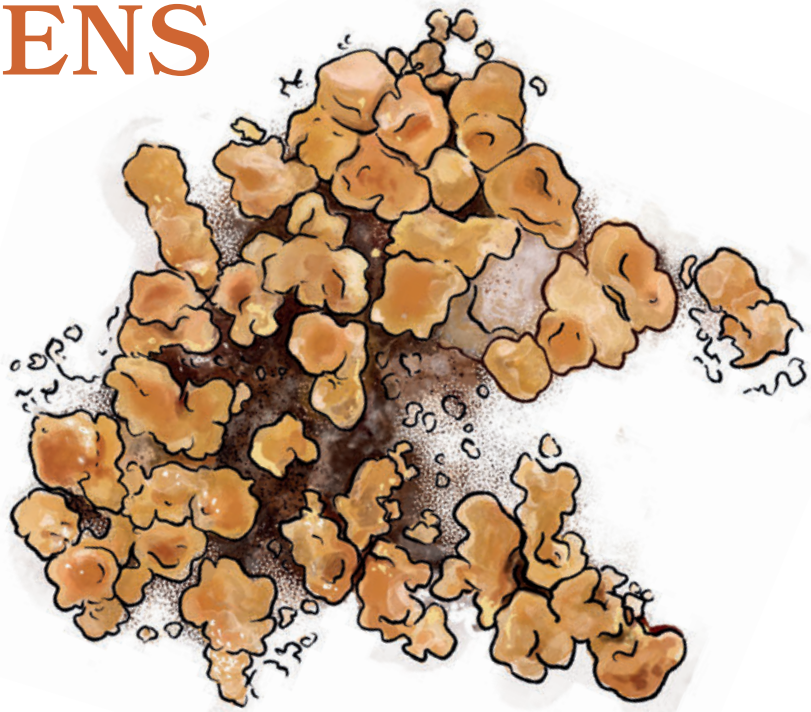
Field notes:

Acarospora strigata general view:

When dry, this lichen turns a pale, chalky white – perfect camouflage on desert rocks – but darkens to brown after rain.

Acarospora strigata detail of areoles:

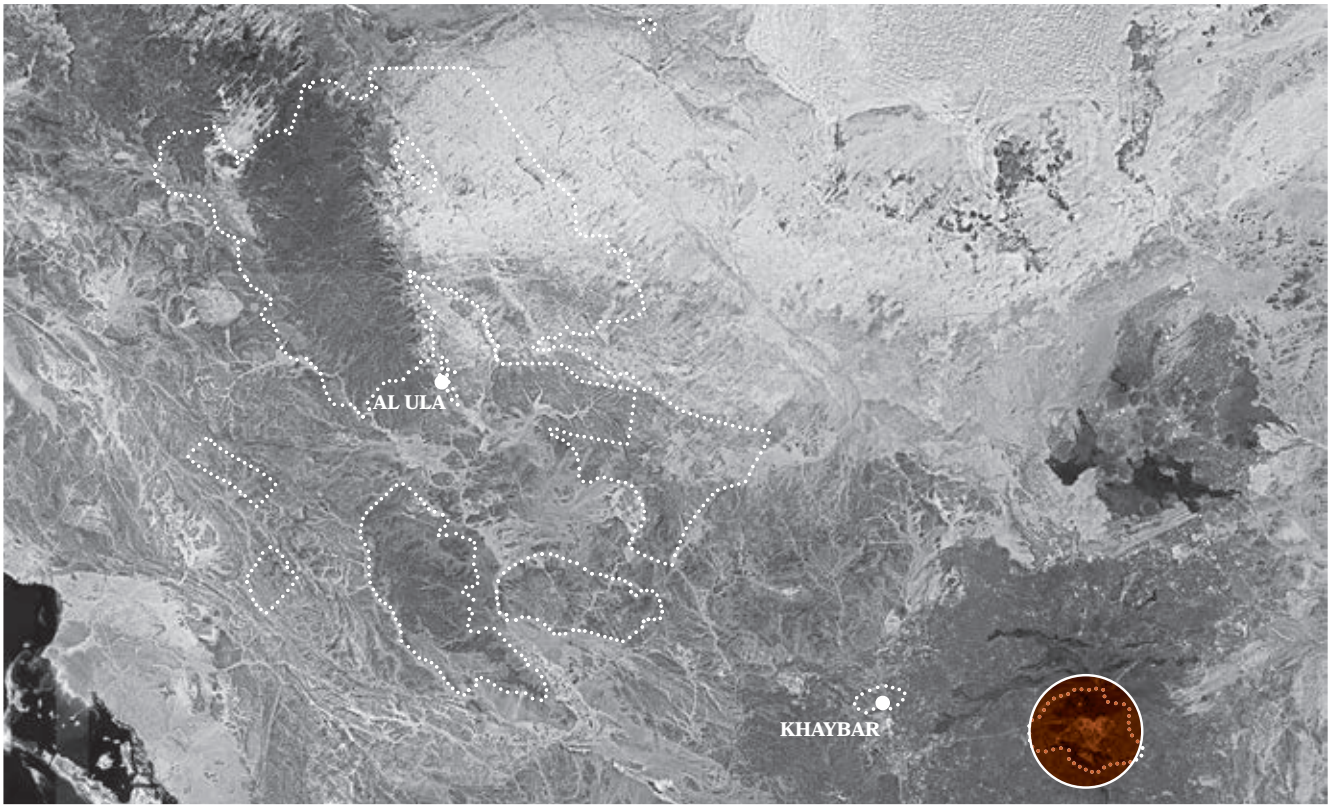
CALOPLACA IRRUBESCENS



Caloplaca Irrubescens
J. Steiner

Description: This **crustose** to subsquamulose lichen forms thin, continuous patches closely attached to rock surfaces. The thallus is smooth and brightly coloured, ranging from orange to reddish when dry and sunlit, and fading to pale orange or yellow in wet, shaded conditions. Its edges are usually diffuse, blending into the substrate rather than forming a clear outline.

Occurrence in AlUla and Khaybar White Volcano



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CALOPLACA IRRUBESCENS

(Nyl. ex Arnold) Zahlbr

Family:
Teloschistaceae

Habitat:
Rock surfaces of igneous rock found on the inclined slopes of volcanic and mountain landscapes.

Substrate preference:
Saxicolous

Growth form:
Crustose

Photobiont:
Green algae other than Trentepohlia

Reproductive strategy:
Sexual, via apothecia

Commonness-rarity in the region (CRI (1-5)):

☐ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the vibrant orange surface and scattered dark apothecia, showing a distinct colour change from bright orange in sunlit conditions to light orange or yellow under shaded conditions.

Microhabitat: Hard, vertical surfaces on angular boulders.

Acarospora lavicola typically grows on hard, acidic rocks such as basalt and granite, and is often found on surfaces exposed to both rain and full sunlight. Its extreme habitat and subtle features make it an expert of survival on barren hard volcanic rocks like basalt.

Field notes:

Caloplaca irrubescens general view:

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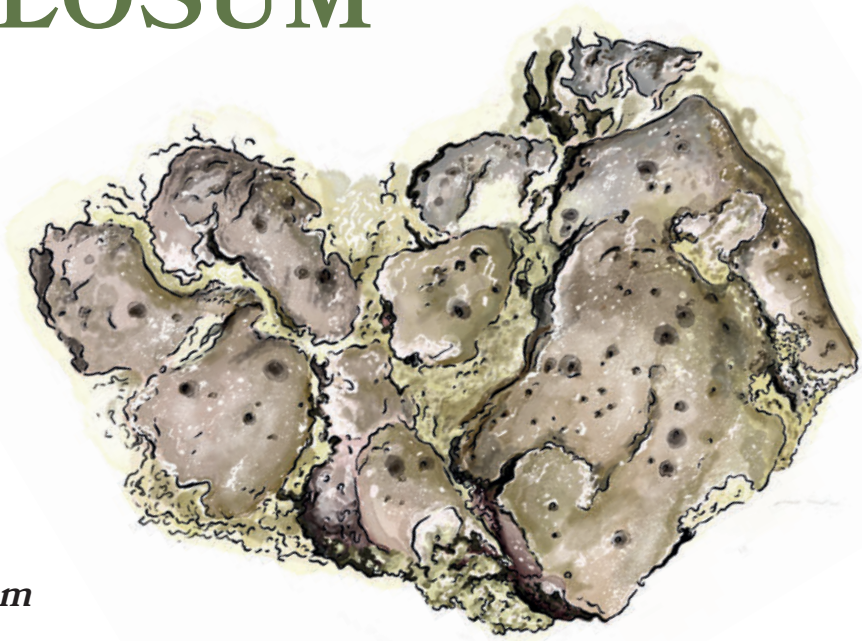
Though tiny, this vivid orange lichen often stands out brightly on rock surfaces, almost as if it were glowing.

Caloplaca irrubescens detail of apothecia:

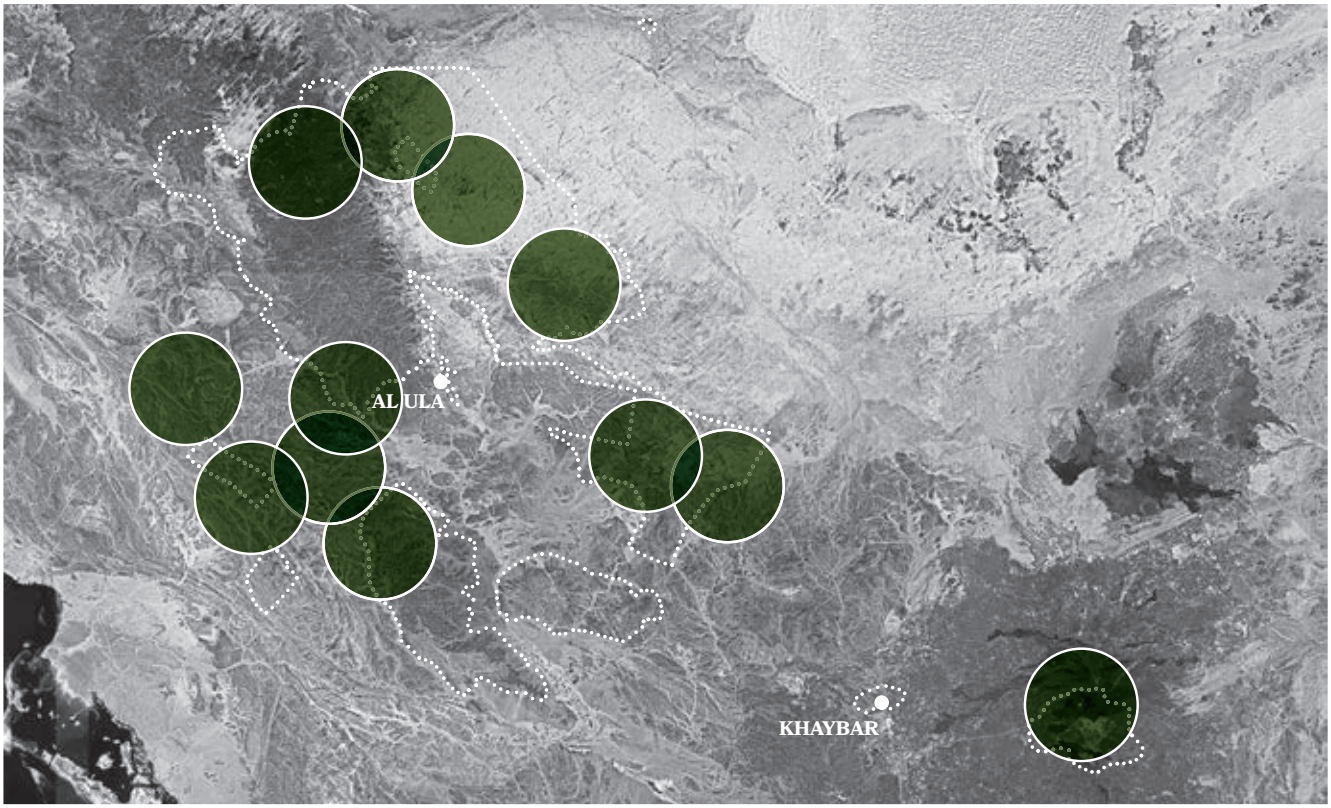
CATAPYRENIUM SQUAMULOSUM



Catapyrenium Squamulosum
(Ach.) Breuss

Description: This **squamulose** lichen grows directly on soil, forming compact patches of small, rounded to elongated squamules that are brown to olive in colour. The upper surface is often smooth or slightly roughened, and the edges of the squamules may lift slightly when dry. The thallus is somewhat rosette-forming but lacks lobes.

Occurrence in AlUla and Khaybar White Volcano



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CATAPYRENIUM SQUAMULOSUM

(Ach.) Breuss

Family:
Verrucariaceae

Habitat:
On mud flats and compact gravel in the valleys and inclined slopes of all major geological formations.

Substrate preference:
Terricolous and Muscicolous

Growth form:
Squamulose

Photobiont:
Green algae other than Trentepohlia

Reproductive strategy:
Sexual, via immersed perithecia

Commonness-rarity in the region (CRI (1-5)):

✓ **Present in AlUla**
✓ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the rosette-like squamules on bare soil, with completely immersed perithecia hidden within the thallus, and the colour shift from green (wet) to brown (dry).

Microhabitat: Mud flats beneath boulder overhangs or compacted soil in rock crevices.

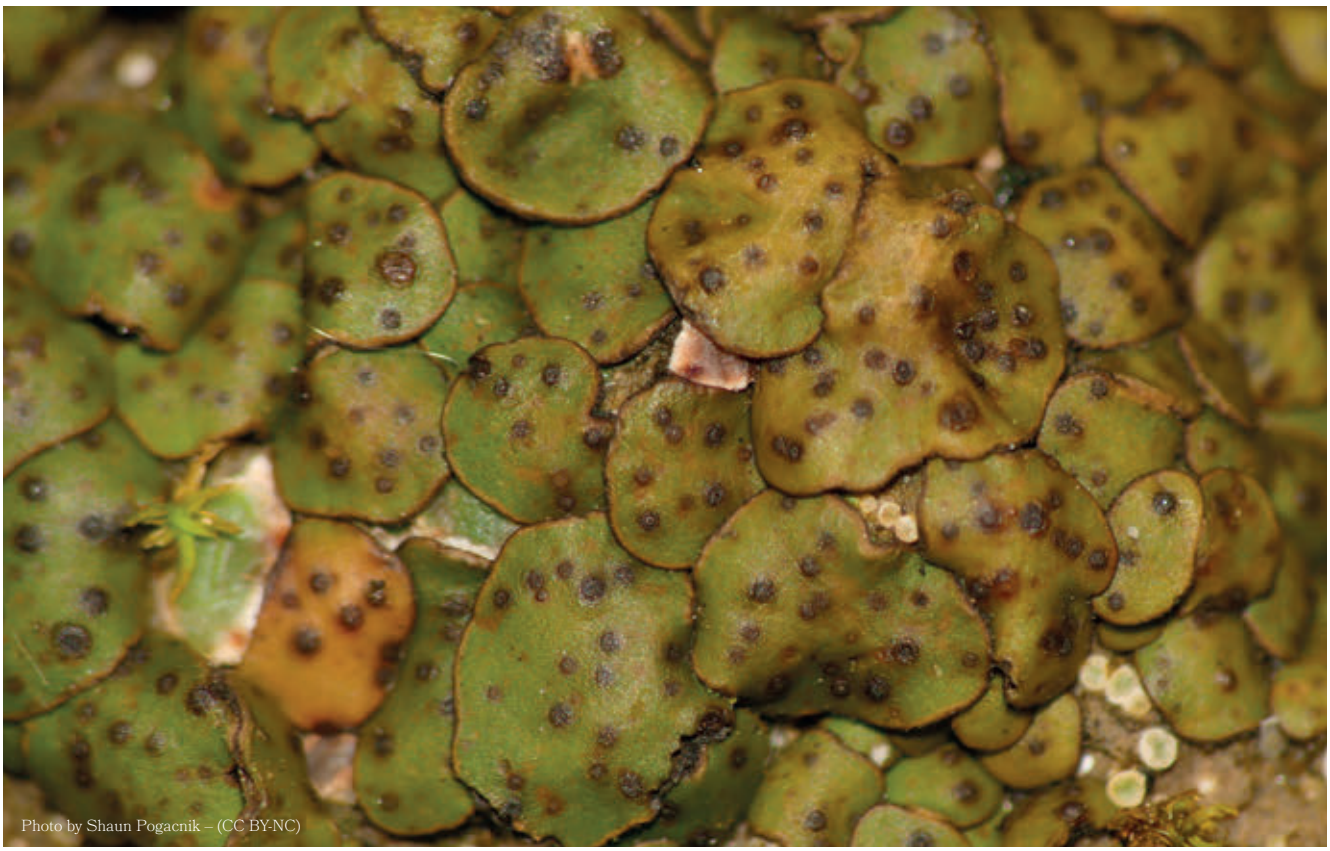
It is widely distributed in dry, open environments, particularly where the soil is undisturbed and well-drained. The reproductive bodies (perithecia) are entirely immersed and often invisible without magnification. Its role in early colonization of bare soils makes it an important contributor to biological soil crusts and soil stability.

Field notes:

Catapyrenium squamulosum general view:

This soil-dwelling lichen looks like miniature leafy rosettes, yet it hides its reproductive structures entirely within the thallus.

Catapyrenium squamulosum detail of a wet, green thallus:

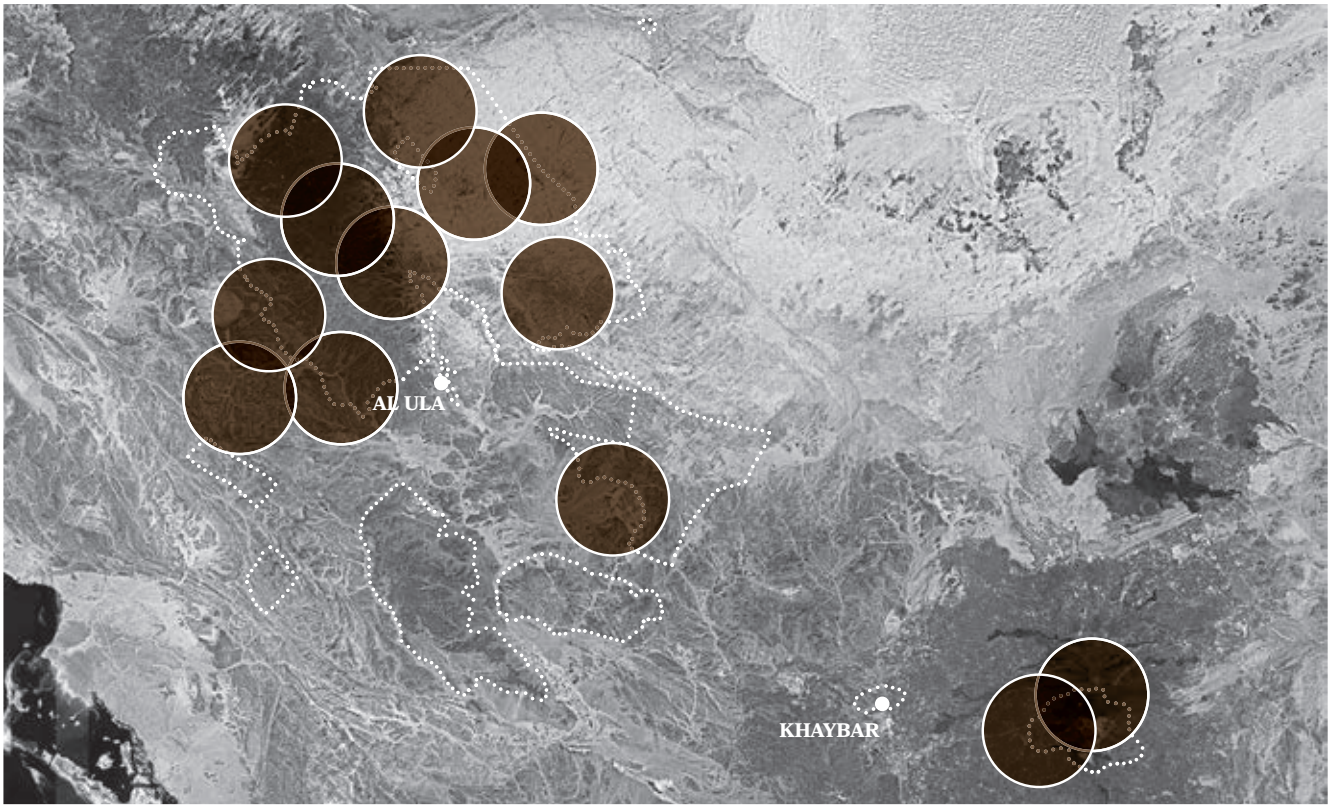


ENCHYLIUM TENAX

Enchylium tenax
(Sw.) Gray

Description: This cyanobacterial lichen forms dark, gelatinous, often irregular thalli that lie directly on the soil or mossy ground. When moist, it appears greenish to dark olive and gelatinous; when dry, it contracts into a brittle, blackish crust. The surface may be smooth or slightly folded, sometimes resembling liverworts at first glance.

Occurrence in AlUla and Khaybar White Volcano



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ENCHYLIUM TENAX

(Sw.) Gray

Family:
Collemataceae

Habitat:
On mud flats and rock surfaces in the valleys and inclined slopes of all major geological formations.

Substrate preference:
Terricolous, Saxicolous and Muscicolous

Growth form:
Foliose (gelatinous)

Photobiont:
Cyanobacteria

Reproductive strategy:
Mainly sexual (via apothecia); also vegetative (thallus fragmentation)

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | 3 - Uncommon | 4 - Common | **5 - Very common**

☑ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the stark difference between dry and wet thalli – when dry they appear black and shrivelled, while when wet they become olive, gelatinous, swollen, and have a jelly-like texture.

Microhabitat: Mud flats beneath boulder overhangs or compacted soil in rock crevices.

It plays a crucial ecological role in biological soil crusts, helping bind soil particles and reduce erosion. It is common in seasonally dry habitats, where it can quickly absorb water and resume photosynthesis after even brief moisture events. It spreads both sexually (via apothecia) and asexually by fragmentation.

Field notes:

Enchylium tenax general view:

This jelly-like lichen shrivels into a crisp black crust when dry but rehydrates and swells dramatically after rain.

Enchylium tenax detail of apothecia:

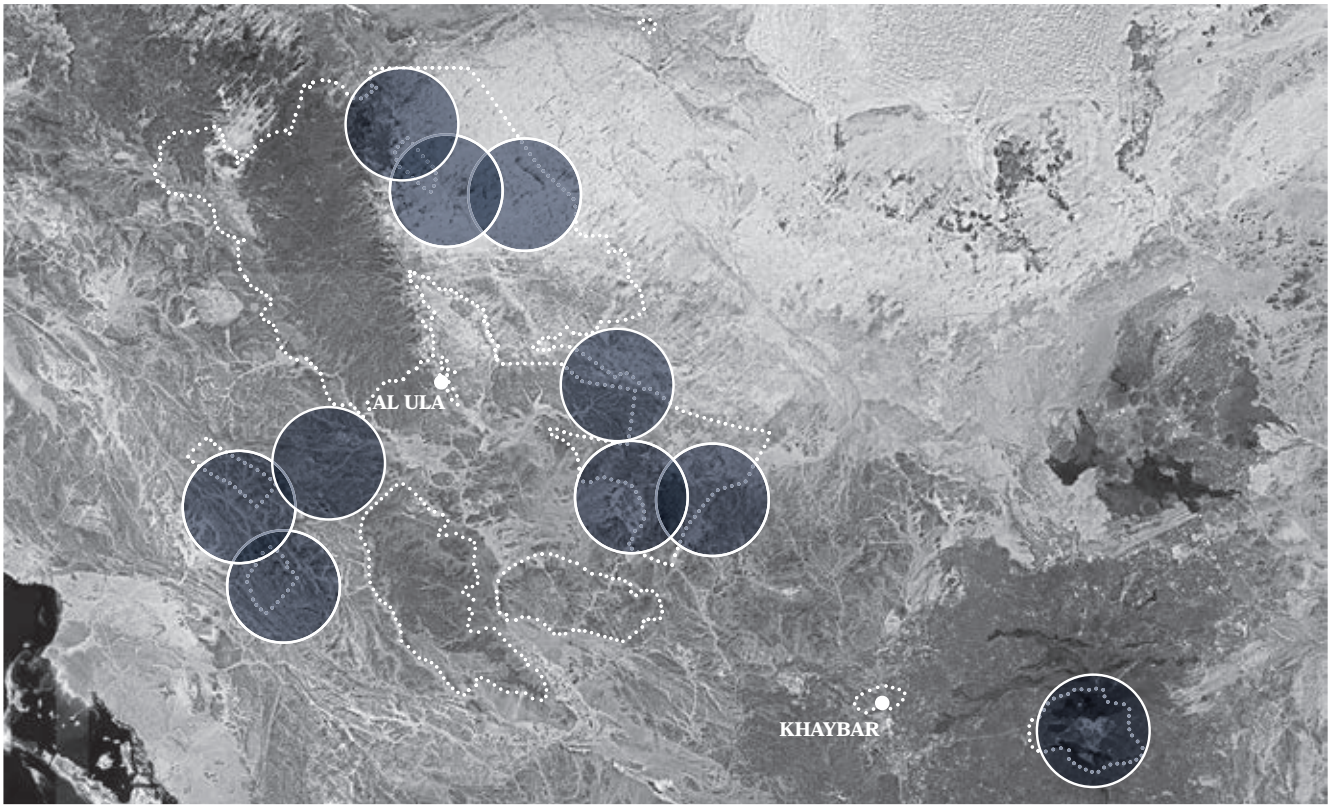
Photo by Simonetta Peruzzi.

GLOEOHEPPIA TURGIDA

Gloeoheppia Turgida
(Ach.) Gyeln

Description: *Gloeoheppia turgida* is a small, **squamulose** to almost foliose lichen with a thick, swollen thallus composed of round to kidney-shaped lobes. It is often reddish-brown to dark olive, with a smooth or slightly wrinkled surface. The thallus is tightly appressed to the substrate and can appear cushiony when hydrated.

Occurrence in AlUla and Khaybar White Volcano



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GLOEOHEPPIA TURGIDA

(Ach.) Gyeln

Family:
Lichinaceae

Habitat:
On mud flats and rock surfaces in the valleys and inclined slopes of all major geological formations.

Substrate preference:
Terricolous and Saxicolous

Growth form:
Squamulose

Photobiont:
Cyanobacteria

Reproductive strategy:
Sexual (apothecia, often rare); also vegetative via thallus

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | 3 - Uncommon | **4 - Common** | 5 - Very common

☑ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the thick, compact, turgid lobes with pores (embedded apothecia), and the leathery, sometimes pruinose surface.

Microhabitat: Mud flats beneath boulder overhangs or compacted soil in rock crevices.

It grows on bare soil or rock in arid environments, often in early successional stages of lichen communities. It contains cyanobacteria as a photobiont, allowing it to fix atmospheric nitrogen – a key trait in poor soils. Reproduction is sexual via scattered apothecia, though these are often rare in the field.

Field notes:

Gloeoheppia turgida general view:

This unusual desert lichen partners with cyanobacteria, helping it survive on bare rock and soil in some of the world's driest places.

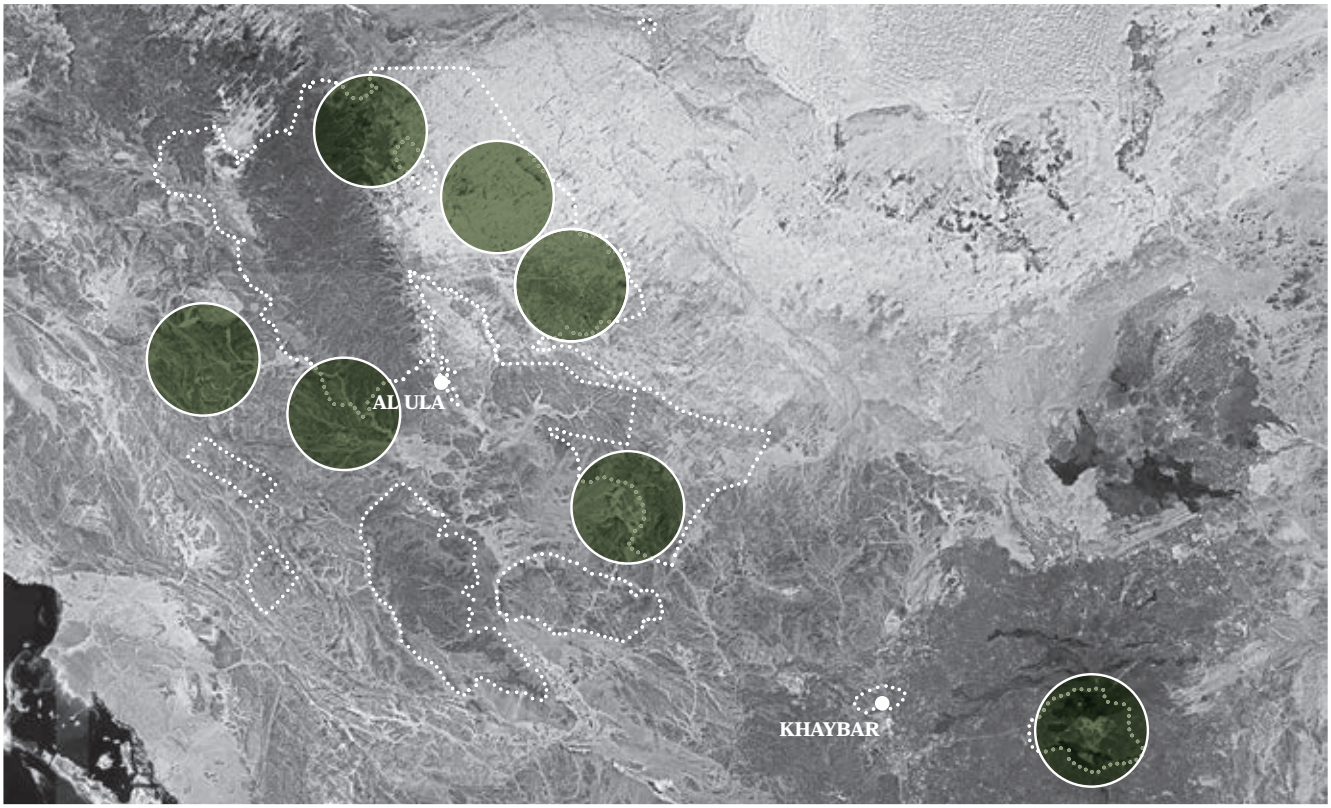
Gloeoheppia turgida detail of inflated squamules:

HEPPIA DESPREAUXII

Heppia Despreauxii
(Mont.) Tuck

Description: *Heppia despreauxii* is a cyanolichen forming small, rounded to lobed **squamules**, often in tight rosettes. The thallus ranges from reddish-brown to blackish when dry, becoming more flexible and greenish when hydrated. Its surface may trap sand or dust, helping it blend into the soil or rock it grows on.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

HEPPIA DESPREAUXII

(Mont.) Tuck

Family:
Porocyphaceae

Habitat:
On mud flats in the valleys and tops of all major geological formations.

Substrate preference:
Terricolous

Growth form:
Squamulose

Photobiont:
Cyanobacteria

Reproductive strategy:
Mainly vegetative; sexual via immersed apothecia (rare)

Commonness-rarity in the region (CRI (1-5)):

✓ **Present in AlUla**
✓ **Present in Khaybar**

Threats:
Mainly human and animal trampling.

Identification tip:
Note its greyish squamules with dust-coated surfaces and darker granulose margins, as well as its rosette-like growth.

Microhabitat: Mud flats beneath boulder overhangs or compacted soil in rock crevices.

Well adapted to arid conditions, it occurs in desert soils, rocky crevices, or mossy ground, often among biological soil crusts. It partners with Scytonema-type cyanobacteria and lacks visible reproductive structures in many specimens, relying heavily on vegetative spread. When present, apothecia are small, dark, and immersed in the thallus.

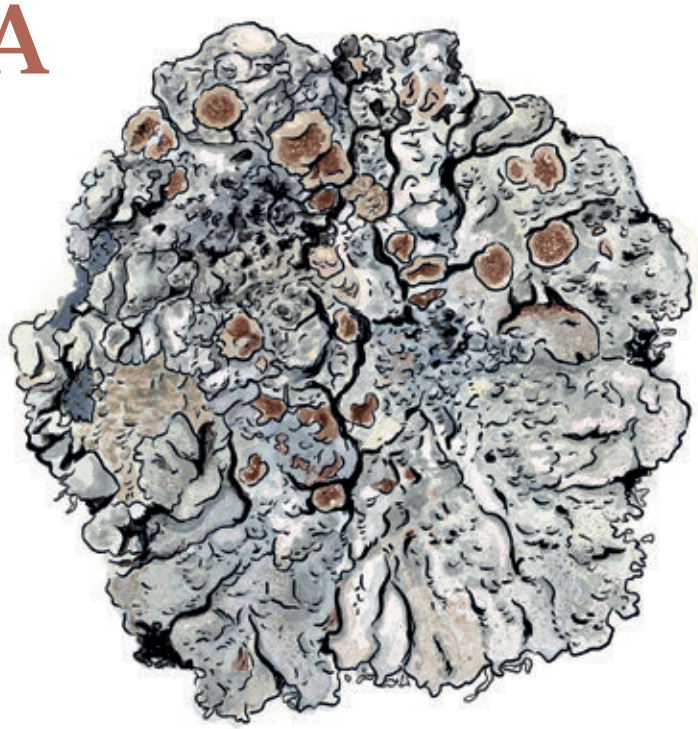
Field notes:

Heppia despreauxii general view:

This jelly-like lichen shrivels into a crisp black crust when dry but rehydrates and swells dramatically after rain.

Heppia despreauxii detail of granulose surface:

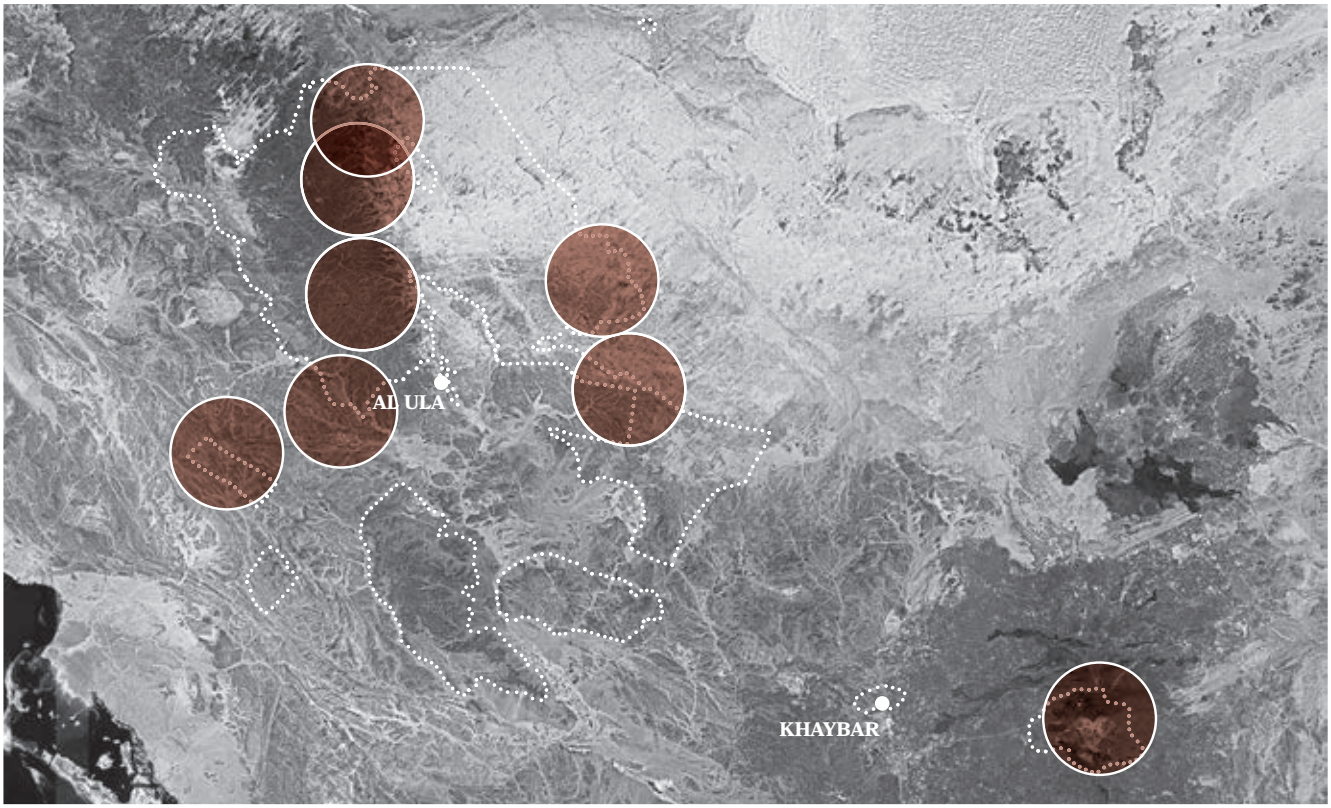
KUETTLINGERIA TEICHOLYTA



Kuettlingeria Teicholyta
(Ach.) Trevis

Description: This **crustose** lichen forms pale grey to whitish patches, often up to 4–8 cm wide. The center looks powdery or grainy due to many tiny reproductive granules, while the edges may show short, smooth lobes that give it a slightly lobed appearance. It has a chalky look and sometimes a faint dark border.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

KUETTLINGERIA TEICHOLYTA

(Ach.) Trevis

Family:
Teloschistaceae

Habitat:
Rock surfaces of sedimentary, metamorphic and igneous rock found in the valleys of volcanic landscapes.

Substrate preference:
Saxicolous

Growth form:
Crustose (placodioid)

Photobiont:
Green algae other than Trentepohlia

Reproductive strategy:
Mainly asexual, by tiny granules (blastidia); rarely by apothecia

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | 3 - Uncommon | **4 - Common** | 5 - Very common

✓ **Present in AlUla**
✓ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the pale crust with a grainy centre and occasional flat, reddish apothecia, as well as the contrast between the central grainy area and the smoother, lobed edge.

Microhabitat: Soft, horizontal to slightly inclined rock surfaces with rounded edges.

Although fruiting bodies (apothecia) are rare, when present they appear as flat, reddish discs with a paler orange margin—usually near the centre of the patch. The thallus mostly spreads by tiny grainy propagules that easily break off and spread, allowing it to colonize dry, sunlit nearby surfaces efficiently.

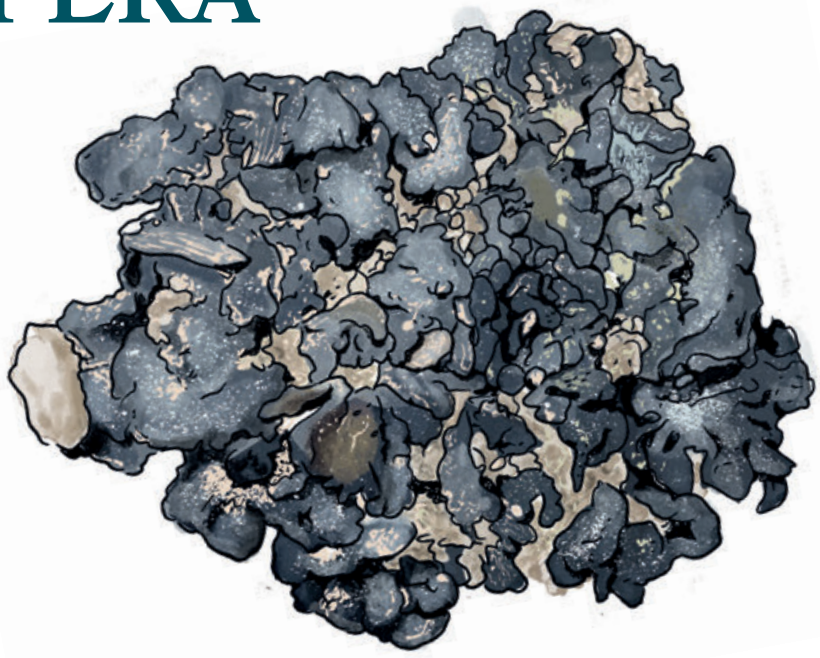
Field notes:

Kuettlingeria teicholyta general view:

Its name comes from the Greek word for “wall,” as it often colonizes old masonry – but it also thrives on sunlit natural rocks.

Kuettlingeria teicholyta detail of apothecia:

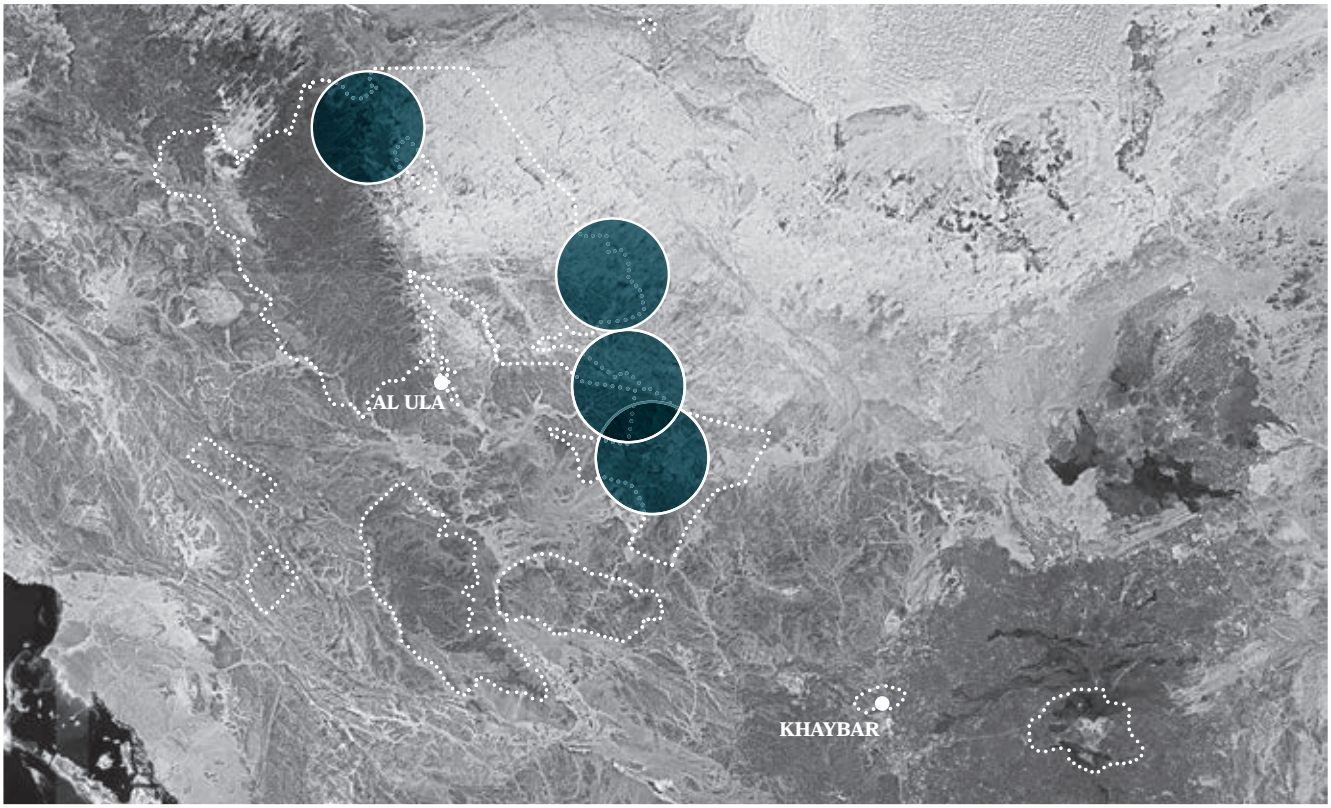
LICHINELLA CRIBELLIFERA



Lichinella Cribellifera
(Nyl.) P.P. Moreno & Egea

Description: This small, dark **squamulose** lichen forms irregular patches on rock or soil, often going unnoticed until examined up close. The thallus is dark brown to almost black, with tiny lobes or squamules that lie flat against the substrate. When present, the apothecia are striking: tiny, rounded, and deeply sunken with a perforated or sieve-like appearance – giving the species its name.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

LICHINELLA CRIBELLIFERA

(Nyl.) P.P. Moreno & Egea

Family:
Lichinellaceae

Habitat:
Rock surfaces of sedimentary, metamorphic, and igneous rocks found on the inclined slopes of all major geological formations.

Substrate preference:
Saxicolous

Growth form:
Squamulose

Photobiont:
Cyanobacteria

Reproductive strategy:
Sexual via distinctive sunken apothecia

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | 3 - Uncommon | **4 - Common** | 5 - Very common

- [x] **Present in AlUla**
- [ ] **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
When hydrated, note the distinctive, “sieve-like” apothecia sunken into the dark squamules, with their rounded, perforated disks creating a striking contrast against the surrounding thallus.

Photo by Maysam Yabandeh on Pixnio

Microhabitat: Water seepages - narrow pathways where runoff concentrates, providing intermittent moisture.

Thanks to its cyanobacterial photobiont, it can fix nitrogen and contribute to early stages of ecological succession. Reproduction is mostly sexual via these unique apothecia, though they may be few in number.

Field notes:

Lichinella cribellifera general view:

Its name means “bearing a small sieve” – a nod to its tiny apothecia that resemble miniature craters or mesh-like openings.

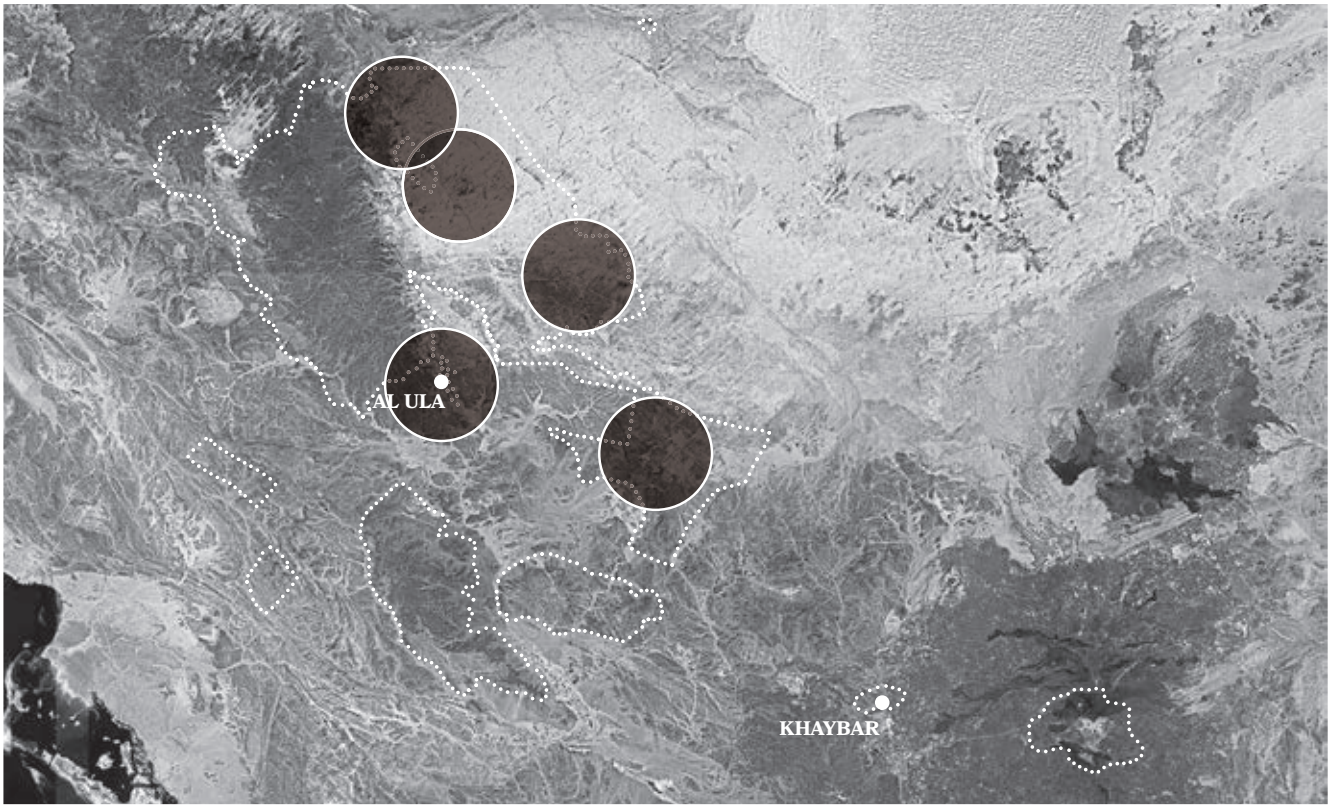
Lichinella cribellifera detail of the lobe margins hiding immersed apothecia:

LICHINELLA STIPATULA

Lichinella Stipatula
Nyl.

Description: This minute, filamentous cyanolichen forms tiny tufts of upright, blackish to olive-brown lobes rarely exceeding a few millimetres in height. The lobes are thread-like, sometimes flattened or forked, and grow vertically in dense little bundles. Despite its small size, the thallus is often well anchored to the substrate, especially in rock crevices.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

LICHINELLA STIPATULA

Nyl.

Family:
Lichinellaceae

Habitat:
Rock surfaces of sedimentary, metamorphic, and igneous rocks found on the inclined slopes of all major geological formations.

Substrate preference:
Saxicolous

Growth form:
Fruticose

Photobiont:
Cyanobacteria

Reproductive strategy:
Mostly vegetative; sexual reproduction via apothecia (rare)

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | 3 - Uncommon | **4 - Common** | 5 - Very common

- [x] **Present in AlUla**
- [ ] **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note its tiny, vertical, tufted lobes – dark, hair-like, and only a few millimetres tall – growing in compact clumps directly on rock.

Photo by Maysam Yabandeh on Pixnio

Microhabitat: Water seepages - narrow pathways where runoff concentrates, providing intermittent moisture.

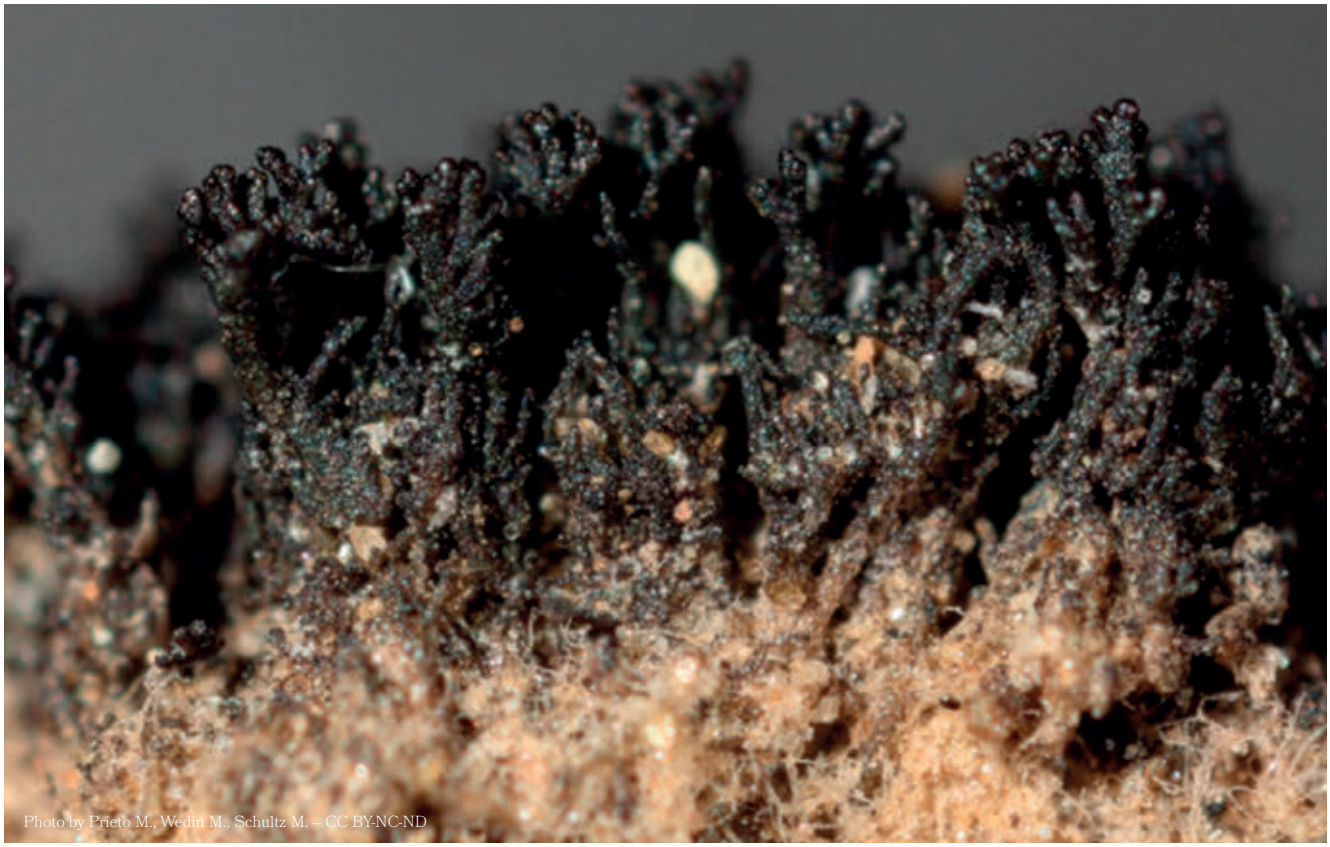
It grows on dry, sun-exposed siliceous rocks, particularly in arid or semi-arid climates. It contains cyanobacteria as its photobiont and contributes to nitrogen fixation in harsh, nutrient-poor habitats. Apothecia are rarely observed; the lichen often spreads vegetatively.

Field notes:

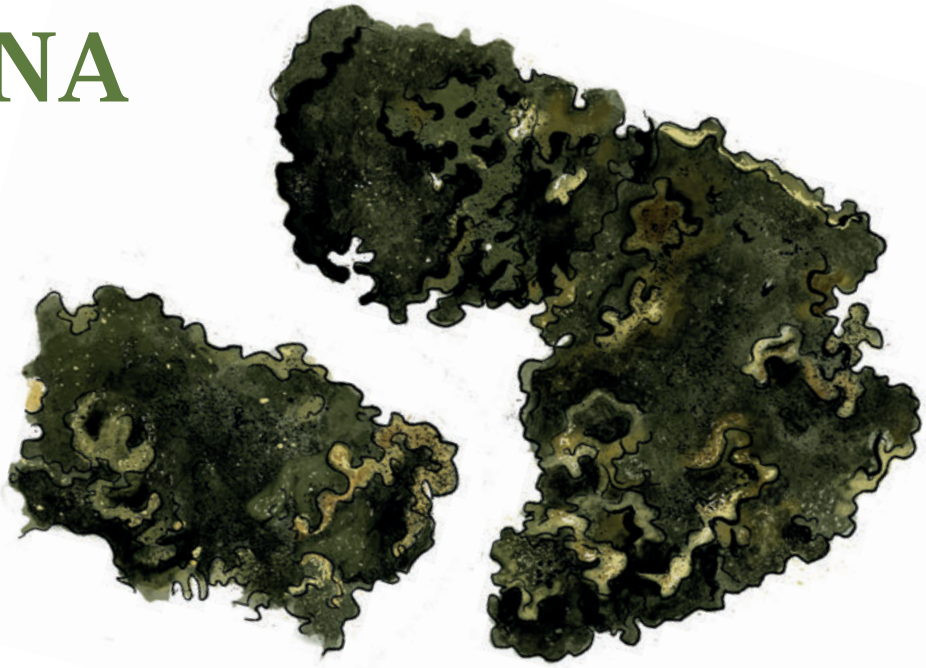
Lichinella stipatula general view:

Its name refers to the “bundled” habit of its fine upright lobes, often forming tiny tufts barely visible to the naked eye.

Lichinella stipatula detail of minute, fruticose, coral-like thallus:



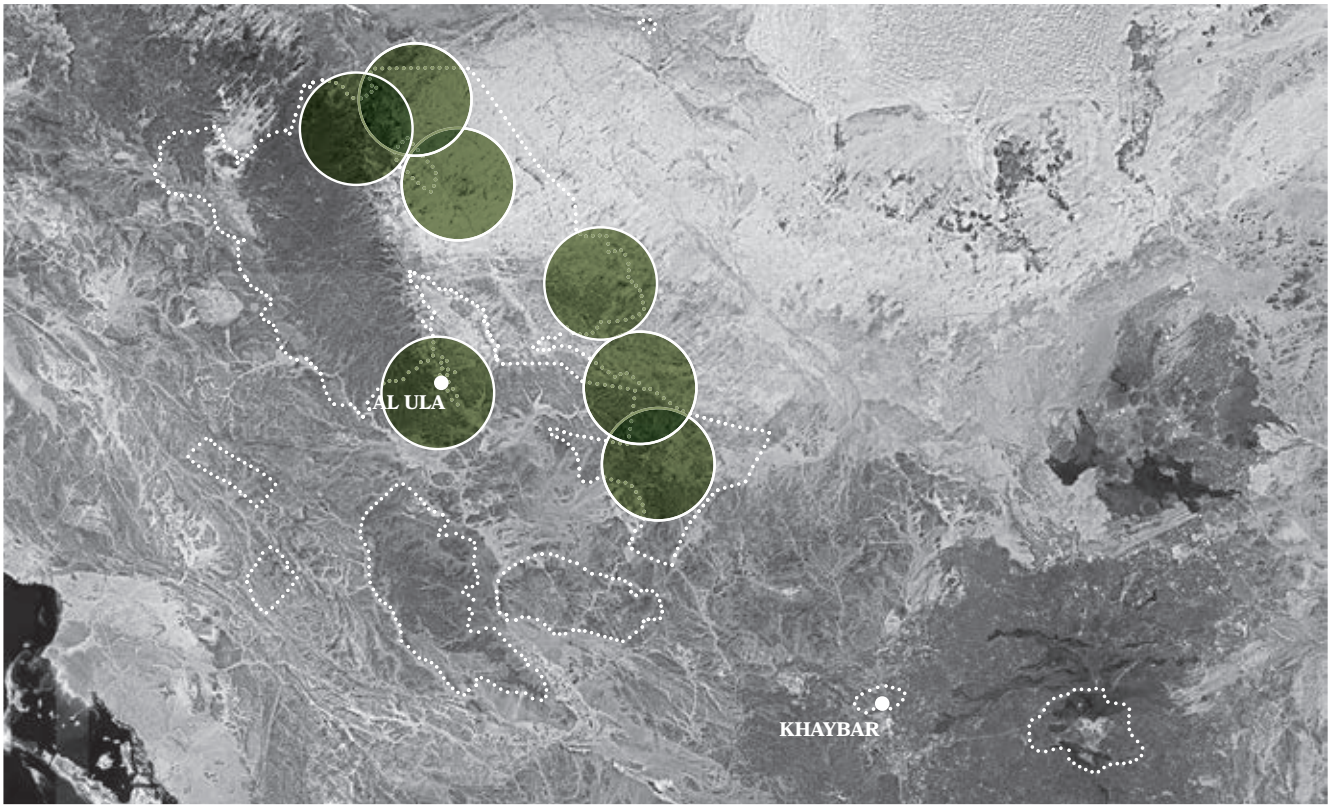
PELTULA AFRICANA



Ppeltula Africana
Nyl.

Description: *Peltula africana* forms orbicular **squamules**, up to 15 mm in diameter, typically dark olive to blackish in colour. The lobes are slightly undulate with incised, often somewhat upturned margins. Squamules are centrally attached to the substrate via a umbilicus, and the underside is typically cracked and carneous brown.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

PELTULA AFRICANA

Nyl.

Family:
Phylliscaceae

Habitat:
Rock surfaces of sedimentary, metamorphic, and igneous rocks found on the inclined slopes of all major geological formations.

Substrate preference:
Saxicolous

Growth form:
Squamulose

Photobiont:
Cyanobacteria

Reproductive strategy:
Sexual (apothecia); also vegetative via soredia

Commonness-rarity in the region (CRI (1-5)):

☑ **Present in AlUla**
☐ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the dark, undulate squamules with incised and upturned margins, the central umbilical attachment, and the cracked lower surface. These features clearly distinguish *Peltula africana* from other raintrack lichens.

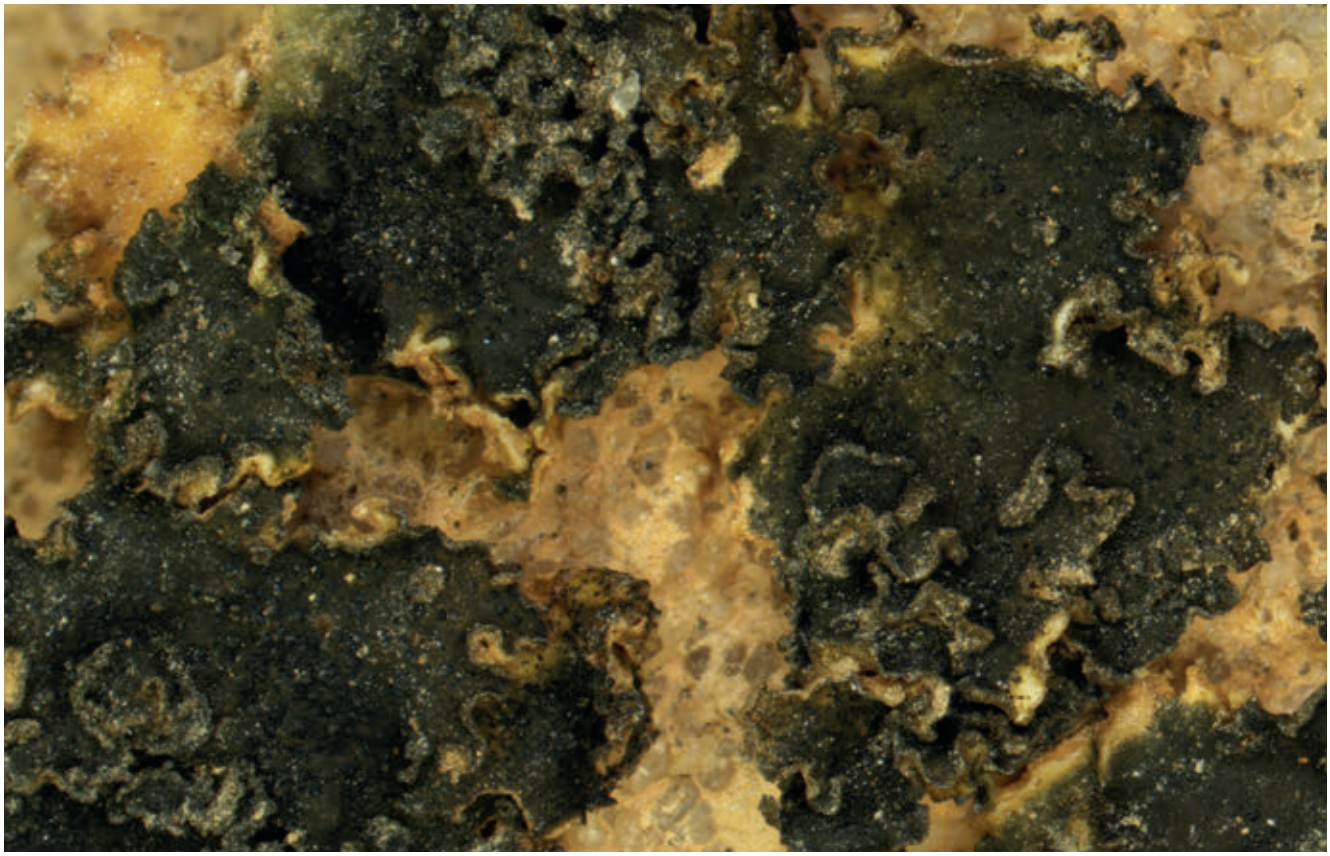
Photo by Maysam Yabandeh on Pixnio

Microhabitat: Water seepages - narrow pathways where runoff concentrates, providing intermittent moisture.

The surface of the thallus may appear smooth to wrinkled, while the margins often display a more granular texture, especially in older or more exposed individuals, due to the presence of soredia.

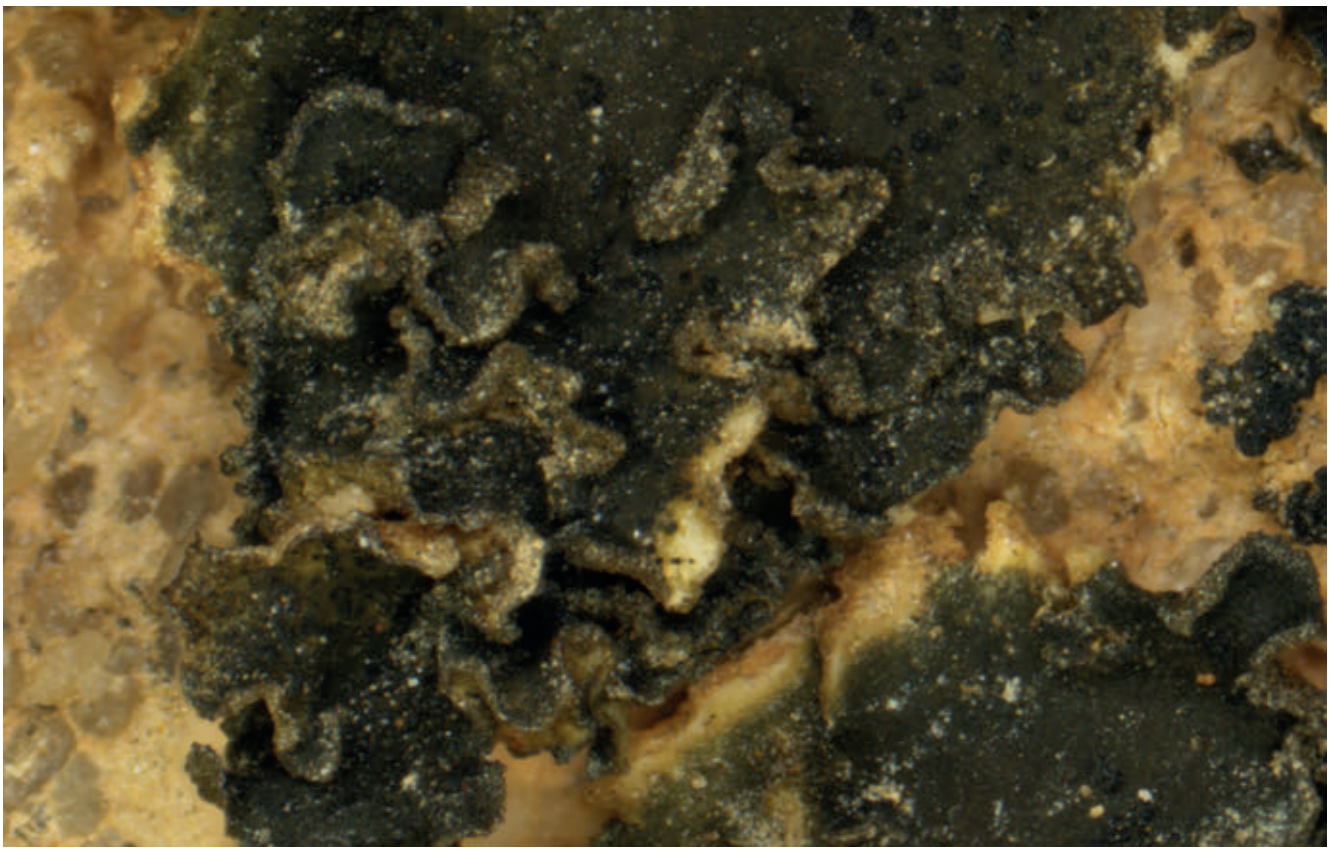
Field notes:

Peltula africana general view:



This species forms the largest squamules in the genus, making it one of the few species that can often be spotted without magnification.

Peltula africana detail of sorediate margin:

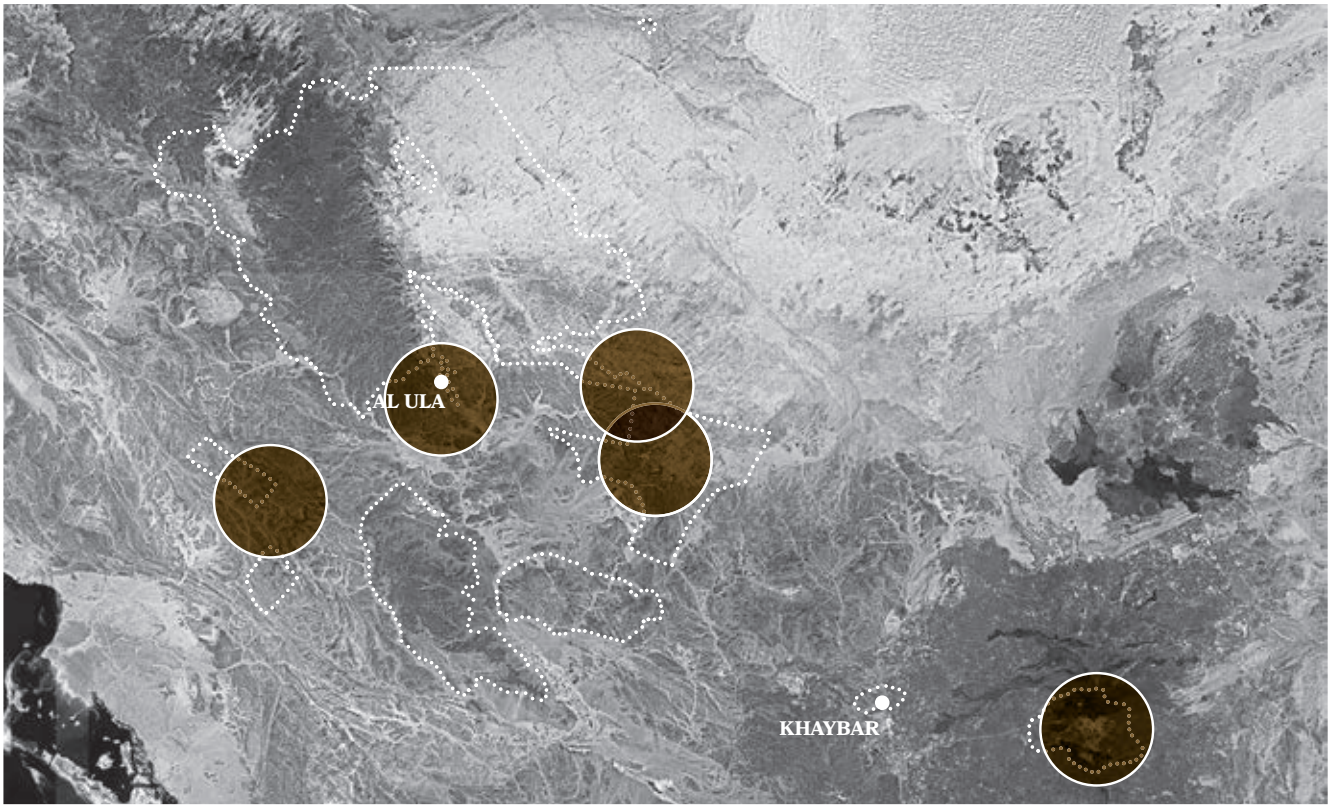


PELTULA EUPLOCA

Peltula Euploca
(Ach.) Poelt

Description: *Peltula euploca* forms small, dark greenish to brown **squamules** with rounded to irregular lobes. The thallus is typically peltate - each squamule attached by a central peg - and may appear scattered or loosely rosette-forming. When hydrated, the surface becomes softer and slightly glossy; in dry conditions, it darkens and tightens against the rock.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

PELTULA EUPLOCA

(Ach.) Poelt

Family:
Phylliscaceae

Habitat:
Rock surfaces of sedimentary, metamorphic, and igneous rocks found on the inclined slopes of all major geological formations.

Substrate preference:
Saxicolous

Growth form:
Squamulose

Photobiont:
Cyanobacteria

Reproductive strategy:
Sexual (apothecia); also vegetative via soredia

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | **3 - Uncommon** | 4 - Common | 5 - Very common

☑ **Present in AlUla**
☐ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the central umbilicate attachment of each squamule and the margins, partially to fully defined by grey to bluish soredia.

Microhabitat: Water seepages - narrow pathways where runoff concentrates, providing intermittent moisture.

It is a typical and often dominant species in seepage tracks and rain-runoff zones on inclined, basic siliceous rock. These are moisture-dependent microhabitats in otherwise dry landscapes. As a cyanolichen, it contains cyanobacteria that allow it to fix atmospheric nitrogen, a key trait for surviving on nutrient-poor rock surfaces. Apothecia, when present, are dark and immersed or slightly raised, but often sparse.

Field notes:

Peltula euploca general view:

This tiny, drought-tolerant lichen clings to steep rock faces and can shrink, darken, and go dormant for weeks until the next rainfall.

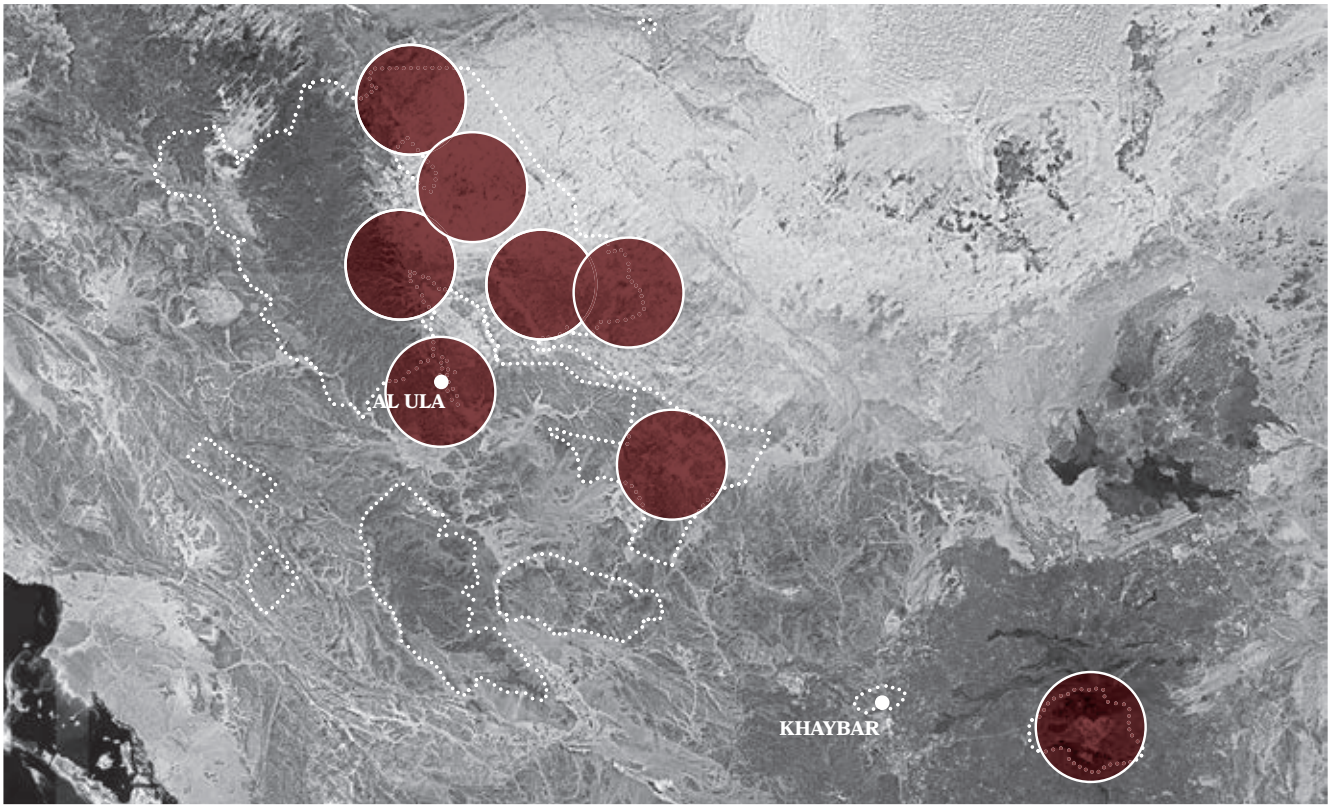
Peltula euploca detail of individual squamule with sorediate margin:

PELTULA OBSCURANS

Peltula Obscurans
(Nyl.) Gyeln

Description: *Peltula obscurans* forms dull olive to brown **squamules** that are round to lobed and often overlap to form irregular patches. The thallus is peltate or sublobate, attached by a central umbilicus or sometimes rhizines, depending on microhabitat conditions. The surface appears flat and matte when dry but turns green and supple when hydrated.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

PELTULA OBSCURANS

(Nyl.) Gyeln

Family:
Phylliscaceae

Habitat:
Rock surfaces of sedimentary, metamorphic, and igneous rocks found on the inclined slopes of all major geological formations.

Substrate preference:
Terricolous and Saxicolous

Growth form:
Squamulose

Photobiont:
Cyanobacteria

Reproductive strategy:
Sexual via apothecia; also vegetative via thallus

Commonness-rarity in the region (CRI (1-5)):

✓ **Present in AlUla**
✓ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the overlapping squamules with a dull surface and small central apothecia, along with both umbilicate and rhizine-based attachment modes.

Photo by Maysam Yabandeh on Pixnio

Microhabitat: Water seepages - narrow pathways where runoff concentrates, providing intermittent moisture.

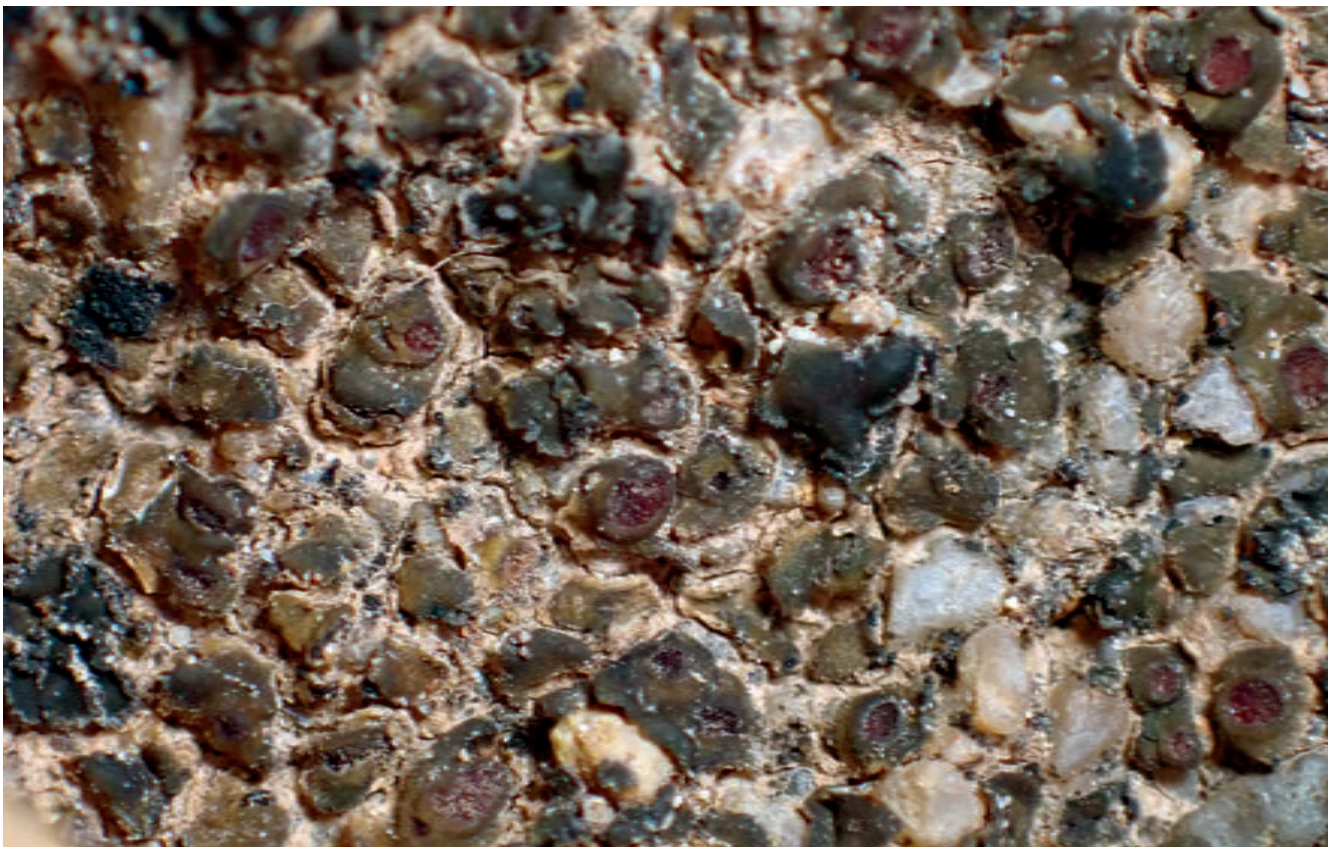
It typically grows on compacted soil or shallow crevices in soft siliceous rock under full sun. Its ability to tolerate desiccation and fix atmospheric nitrogen allows it to establish early in crust communities. Apothecia are small, dark, and usually central, but often sparse. This lichen is well suited to nutrient-poor, arid ecosystems.

Field notes:

Peltula obscurans general view:

This species is a desert survivalist – anchoring itself to dry ground with a central stalk or rhizines and enduring extreme drought for months.

Peltula obscurans detail of squamules bearing apothecia:

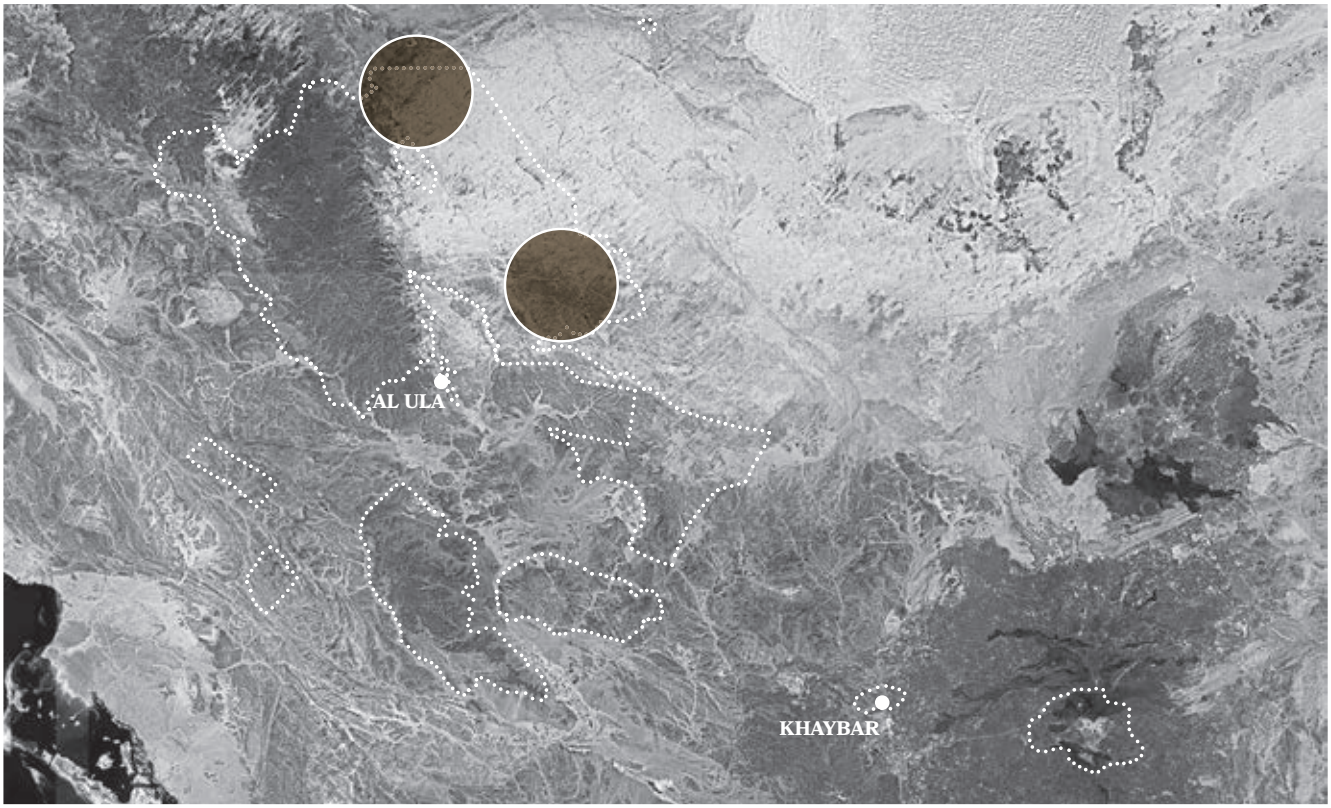


PELTULA PATELLATA

Peltula Patellata
(Bagl.) Swinscow & Krog

Description: *Peltula patellata* forms orbicular to slightly lobed **squamules** up to 4 mm wide, with a distinctive thickened and often darkened margin. These squamules are usually attached to the substrate by a central umbilicus and often host one or more apothecia, which may occupy nearly the whole upper surface.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

PELTULA PATELLATA

(Bagl.) Swinscow & Krog

Family:

Phylliscaceae

Habitat:

On mud flats in the valleys of all major geological formations.

Substrate preference:

Terricolous

Growth form:

Squamulose

Photobiont:

Cyanobacteria

Reproductive strategy:

Sexual, via centrally located apothecia

Commonness-rarity in the region (CRI (1-5)):

- [x] **Present in AlUla**
- [ ] **Present in Khaybar**

Threats:

Mainly human and animal trampling.

Identification tip:

Note the thick, orbicular squamules with raised, darkened margins, and the large apothecia filling the upper surface, giving the lichen its distinctive “dish-shaped” or cookie-like appearance.

Microhabitat: Mud flats beneath boulder overhangs or compacted soil in rock crevices.

It thrives on compacted soil, earth-filled rock crevices, or the margins of soft siliceous rocks in dry, exposed locations. It is frequently found as part of early successional crust communities and can withstand intense sunlight and long dry spells. Its combination of shape, margin thickness, and central apothecia make it relatively easy to distinguish in the field.

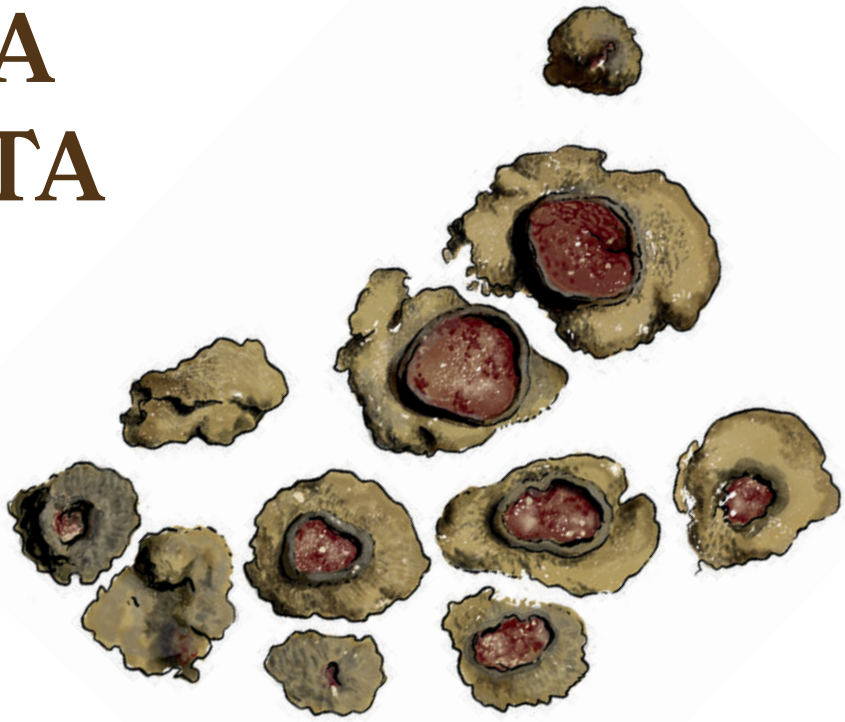
Field notes:

Peltula patellata general view:

This species is named after the Latin word *patella* (small dish), referring to its thick, rounded squamules that resemble tiny plates on the ground.

Peltula patellata detail of squamules bearing apothecia:

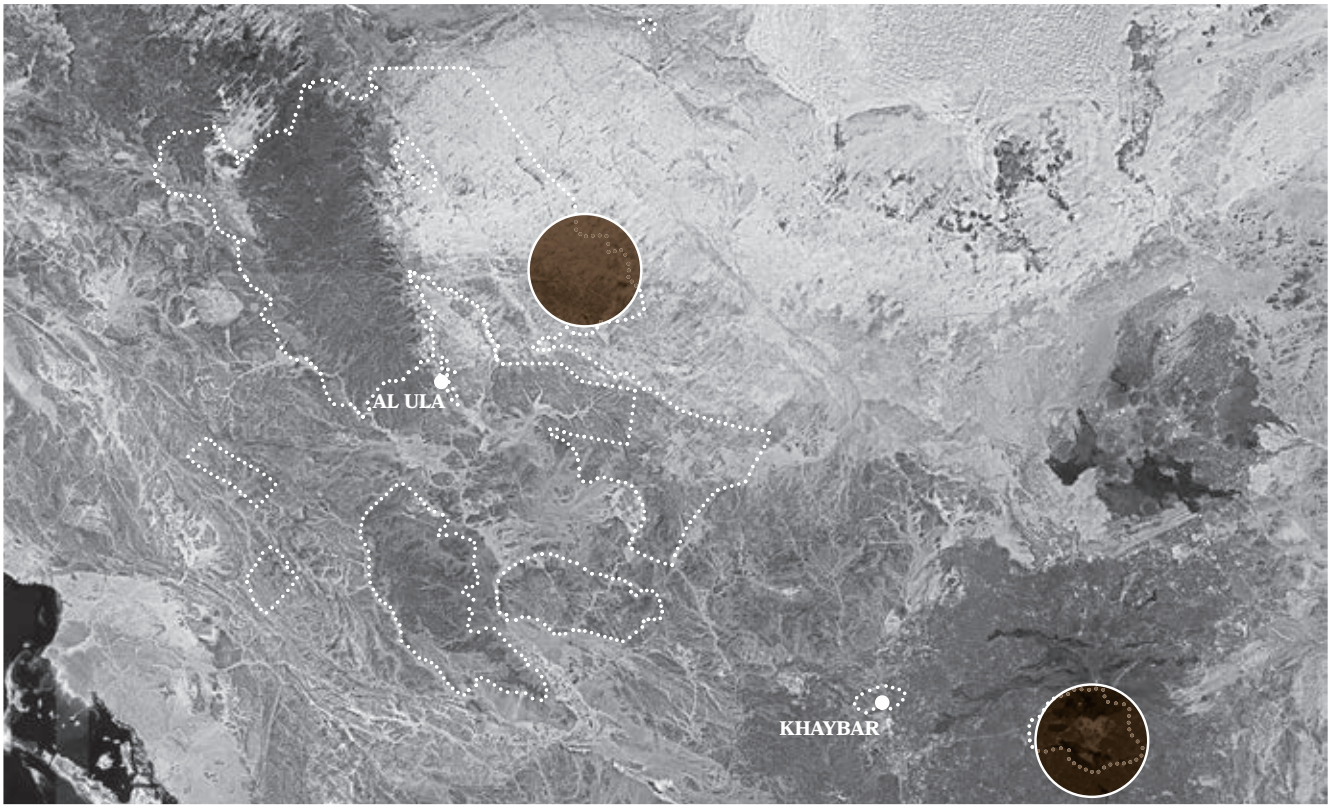
PELTULA RADICATA



Peltula Radicata
Nyl.

Description: The first species of the genus to be described, *Peltula radicata* was originally found in a desert region and is now known to occur across deserts worldwide. It forms orbicular, shield-like **squamules** that are often slightly convex or concave. The yellowish to yellowish-olive thallus has a smooth to slightly grooved or punctate upper surface. Each squamule is anchored to the substrate by a thick central, root-like structure, sometimes with underground branching.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

PELTULA RADICATA

Nyl

Family:
Phylliscaceae

Habitat:
On mud flats and compact gravel in the valleys and tops of all major geological formations.

Substrate preference:
Terricolous

Growth form:
Squamulose

Photobiont:
Cyanobacteria

Reproductive strategy:
Sexual, via centrally located apothecia

Commonness-rarity in the region (CRI (1-5)):

☑ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
Mainly human and animal trampling.

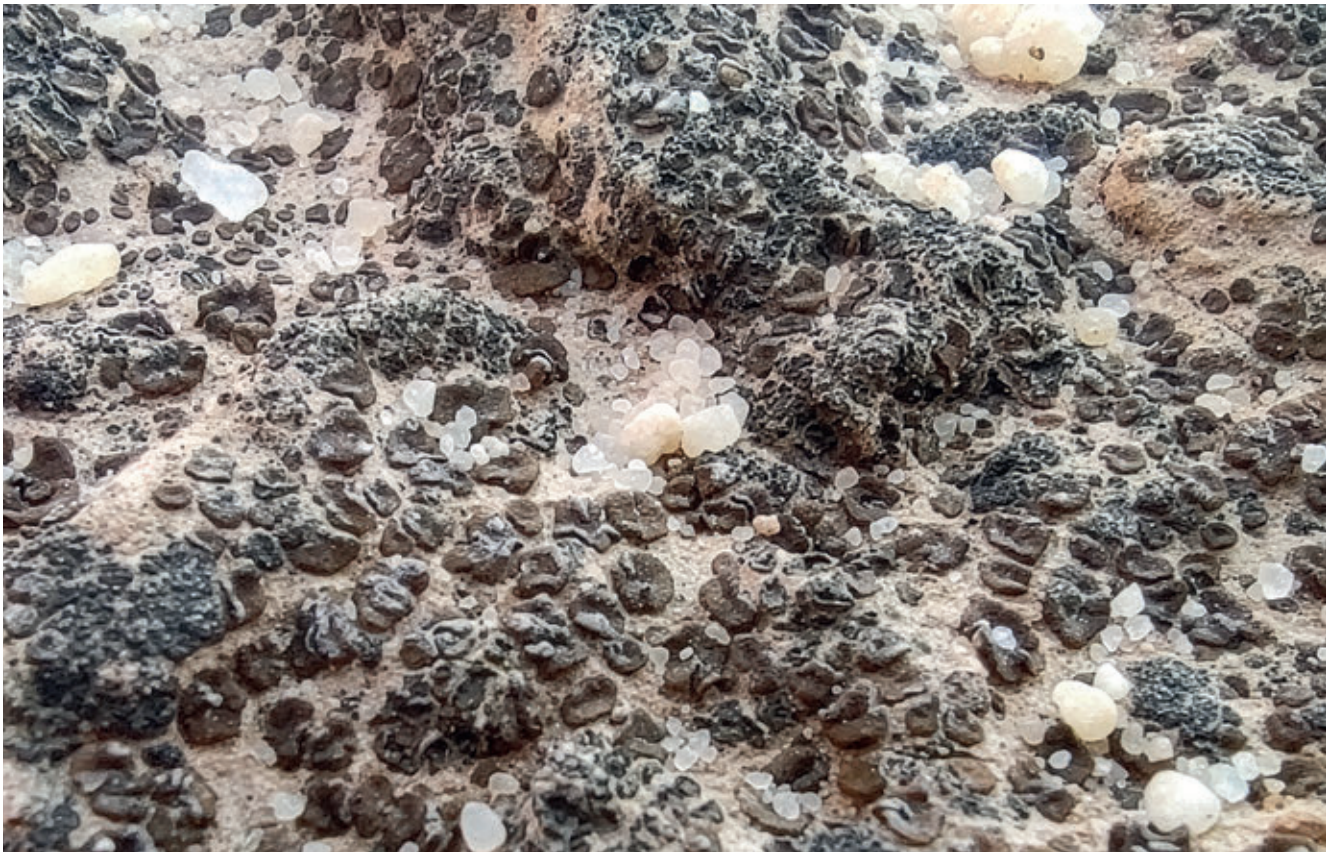
Identification tip:
In addition to its root-like anchoring structures, a useful field characteristic is its yellowish-olive thallus, a colour that clearly sets it apart from other Peltula species found in the region.

Microhabitat: Mud flats beneath boulder overhangs or compacted soil in rock crevices.

Apothecia, when present, are rare, usually solitary, and immersed, with a reddish to brown disc. These reproductive structures are less frequently observed but help confirm identification when visible.

Field notes:

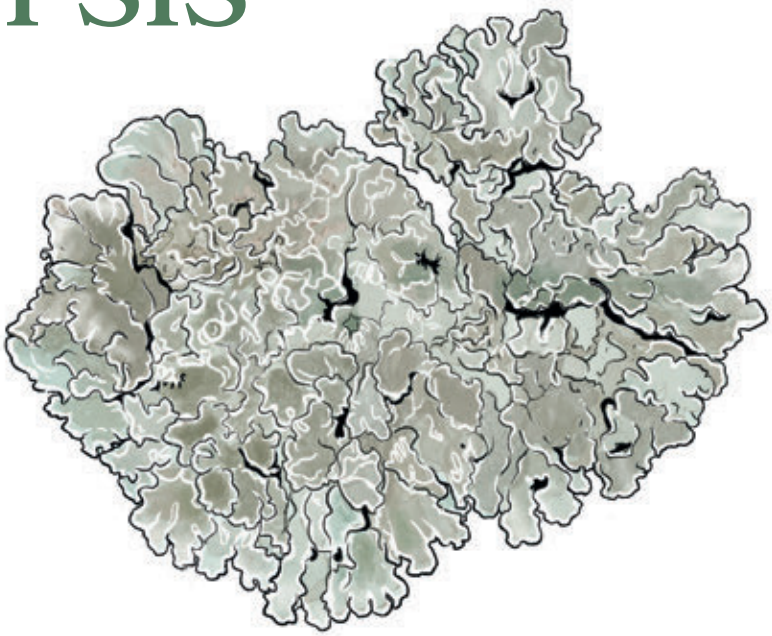
Peltula radicata general view:



The name radicata comes from Latin, meaning “rooted,” in reference to its long, root-like structures. These help anchor the lichen and trap sand and silt particles, contributing to soil stabilization – a critical function in desert environments.

Peltula radicata detail of squamules bearing apothecia:

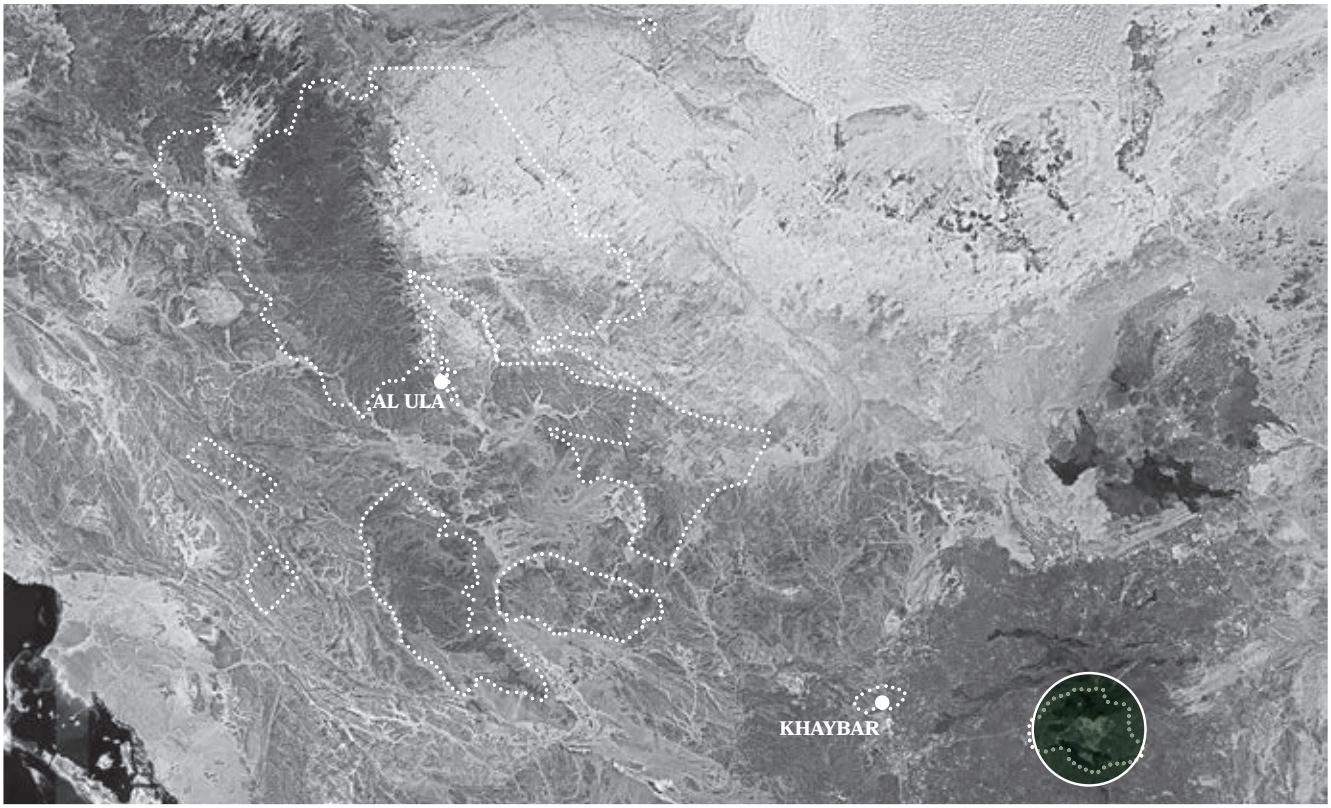
PROTO-PARMELIOPSIS MURALIS



Protoparmeliopsis Muralis
(Schreb.) M. Choisy

Description: *Protoparmeliopsis muralis* is a placodioid lichen forming pale green to greyish-green rosettes up to several centimetres wide. The central part of the thallus is **crustose** and tightly attached, while the margins are lobate, slightly raised, and more loosely attached. The lobe tips are often dusted with white pruina, giving a frosted look, especially in sunny conditions.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

PROTOPARMELIOPSIS MURALIS

(Schreb.) M. Choisy

Family:
Lecanoraceae

Habitat:
Rock surfaces of igneous rock found in the valleys of volcanic landscapes.

Substrate preference:
Saxicolous

Growth form:
Crustose (placodioid)

Photobiont:
Green algae

Reproductive strategy:
Sexual via apothecia; vegetative via marginal lobes

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | 3 - Uncommon | **4 - Common** | 5 - Very common

☐ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the pruinose, elongate marginal lobes, tightly attached crustose centre, and numerous small, pale apothecia that often fill the thallus core.

Microhabitat: Soft, horizontal to slightly inclined rock surfaces with rounded edges.

It grows on dry, exposed rock surfaces in open habitats. It tolerates wide temperature fluctuations and intense sun exposure. Its apothecia are typically frequent, forming small, pale yellow to orange-brown discs clustered in the central area of the thallus.

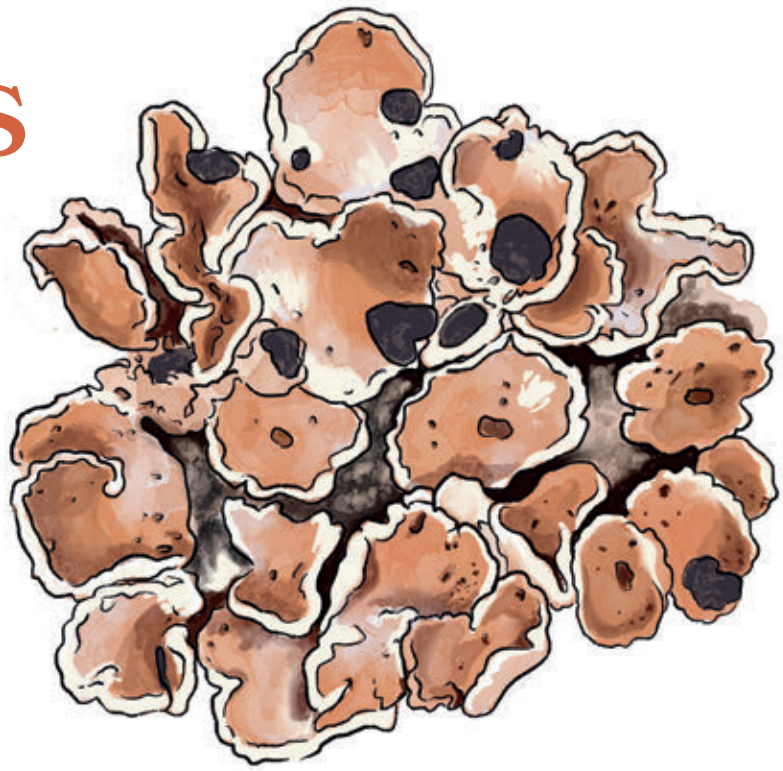
Field notes:

Protoparmeliopsis muralis general view:

Though first described on walls (muralis), it is also common on dry rock outcrops in natural, open habitats.

Protoparmeliopsis muralis detail of apothecia:

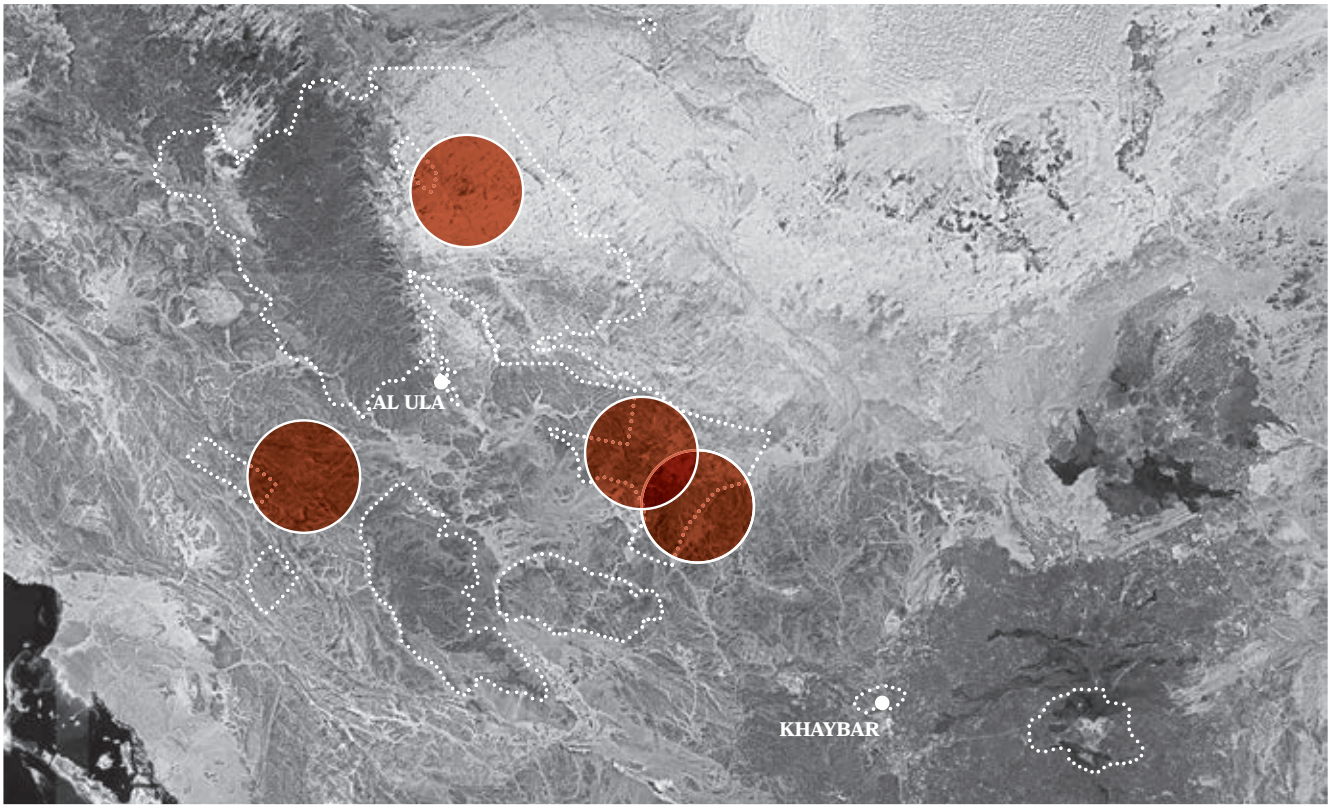
PSORA DECIPIENS



Psora Decipiens
(Hedw.) Hoffm.

Description: *Psora decipiens* is a common and well-known **squamulose** lichen forming flat to slightly raised rosettes made of small, scale-like squamules. These are often brown to reddish, with paler edges that may curl up slightly. The surface is usually matte, and the underside is pale to whitish. The squamules are often loosely attached at the base and may form extensive colonies.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

PSORA DECIPIENS

(Hedw.) Hoffm.

Family:
Psoraceae

Habitat:
On mud flats and compact gravel in the valleys and inclined slopes of all major geological formations.

Substrate preference:
Terricolous

Growth form:
Squamulose

Photobiont:
Green algae other than Trentepohlia

Reproductive strategy:
Sexual, via abundant apothecia

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | **3 - Uncommon** | 4 - Common | 5 - Very common

☑ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
Mainly human and animal trampling.

Identification tip:
Note the rosette-forming squamules spreading across the soil surface, with pale, sometimes curled margins and dark brown to usually black marginal apothecia.

Microhabitat: Mud flats beneath boulder overhangs or compacted soil in rock crevices.

It is a classic component of biological soil crusts in dry grasslands, steppes, and deserts, where it contributes to soil stabilization and moisture retention.
The apothecia are often abundant, appearing as reddish-brown discs with a pale margin. This species is tolerant of drought and disturbance, and one of the most widespread terricolous lichens worldwide.

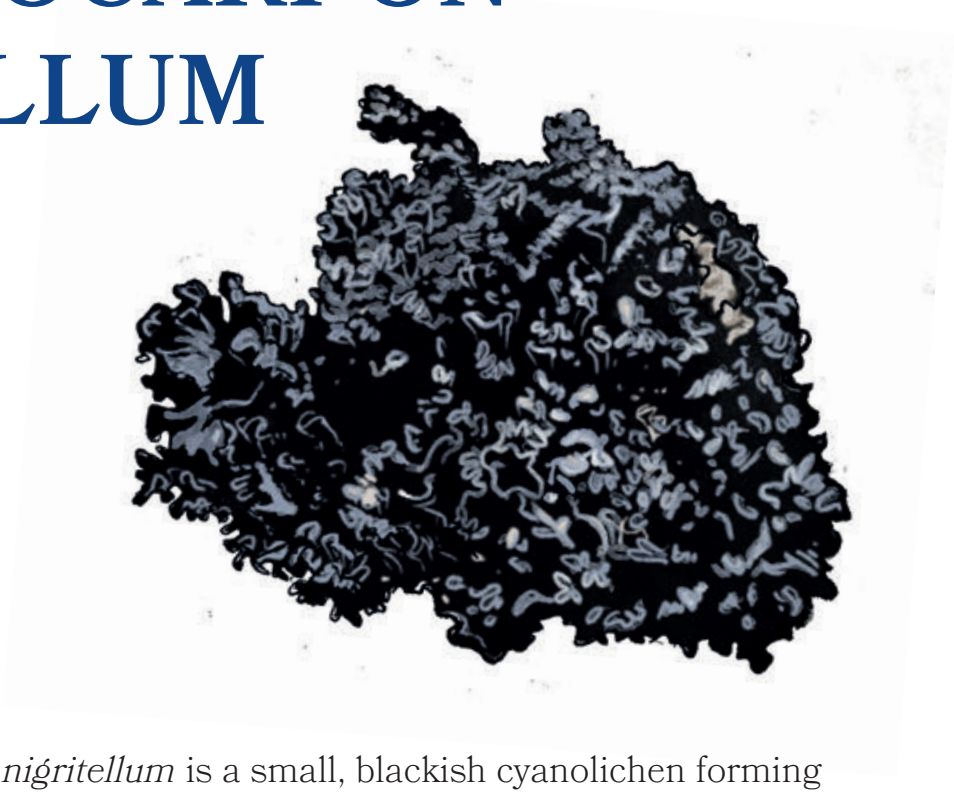
Field notes:

Psora decipiens general view:

This lichen is a global citizen - it grows on every continent except Antarctica and plays a key role in stabilizing dry soils.

Psora decipiens detail of squamules:

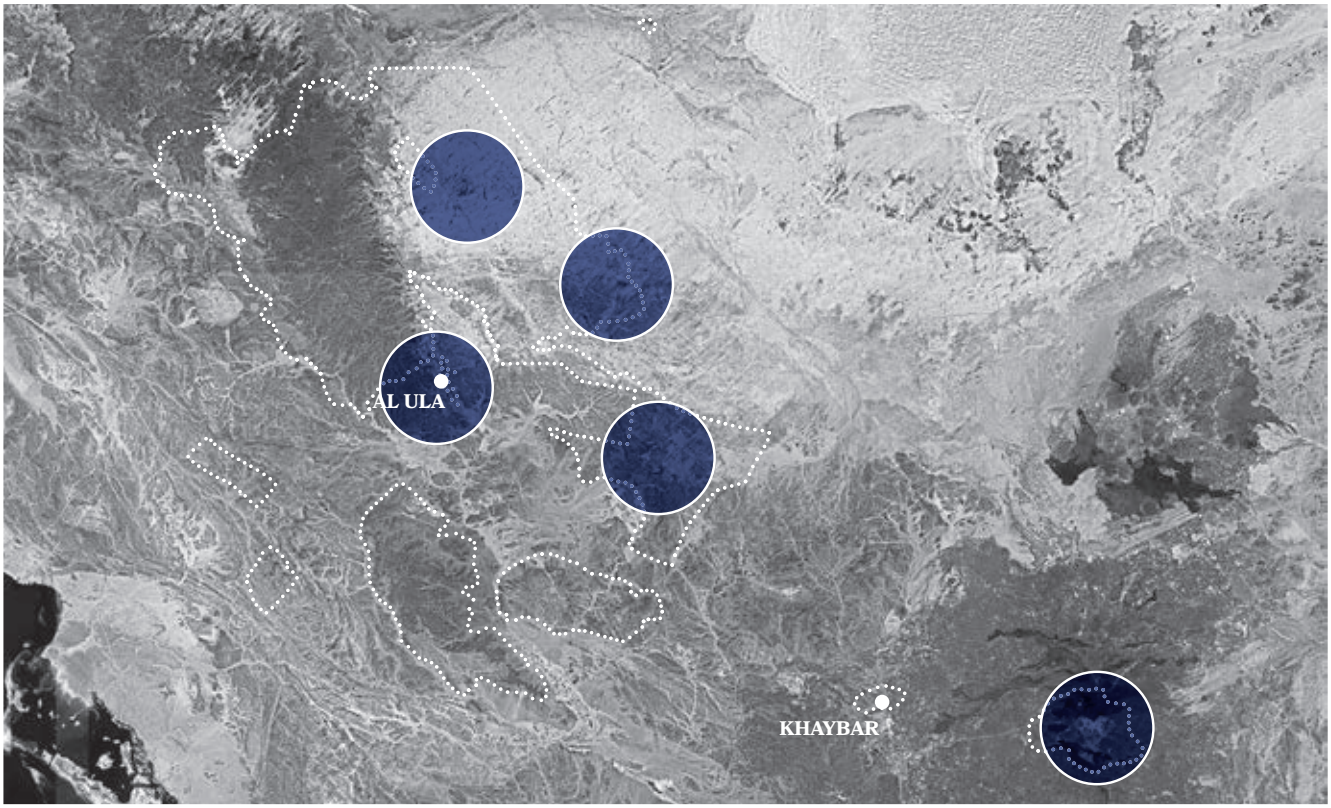
THALLINOCARPON NIGRITELLUM



Thallinocarpon Nigritellum
(Lettau) P.M. Jørg.

Description: *Thallinocarpon nigritellum* is a small, blackish cyanolichen forming polyphyllous cushions up to 3 cm across. The thallus is **squamulose** to small-foliose, dull to slightly glossy, and becomes gelatinous when wet. Squamules or lobes are initially pressed flat, but gradually rise and become erect in the centre of the thallus. The surface is soon densely covered in fine, globose isidia, giving it a granular texture.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

THALLINOCARPON NIGRITELLUM

(Lettau) P.M. Jørg.

Family:
Lichinellaceae

Habitat:
Rock surfaces of sedimentary, metamorphic, and igneous rocks found on the inclined slopes of all major geological formations.

Substrate preference:
Saxicolous

Growth form:
Squamulose (gelatinous)

Photobiont:
Cyanobacteria

Reproductive strategy:
Asexual, via abundant isidia; sexual structures rare or unknown

Commonness-rarity in the region (CRI (1-5)):

1 - Very rare | 2 - Rare | 3 - Uncommon | **4 - Common** | 5 - Very common

☑ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
No major threats have been identified to date.

Identification tip:
Note the dense, black thallus with ascending lobules and granular isidia.
When fully hydrated, it swells like a jelly, evidencing its cushion-forming growth.

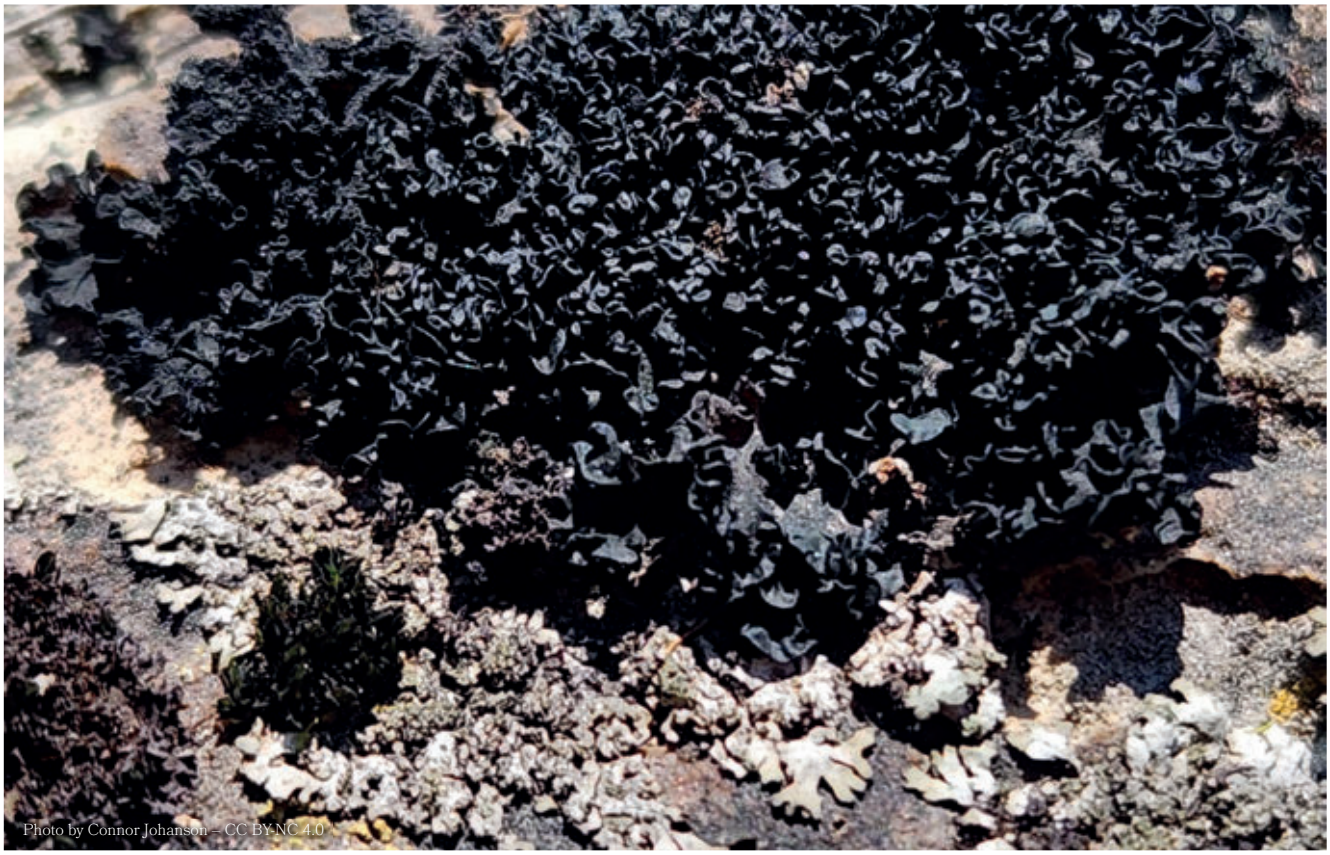
Photo by Maysam Yabandeh on Pixnio

Microhabitat: Water seepages - narrow pathways where runoff concentrates, providing intermittent moisture.

It colonizes steeply inclined, base-rich siliceous rocks – especially in well-lit but moisture-retentive microhabitats such as shaded runoff surfaces or ledges. Its cyanobacterial partner allows it to survive dry periods and contribute to nitrogen fixation. Though often inconspicuous, it forms compact, cushion-like colonies with distinctive erect lobules and a gelatinous response to water.

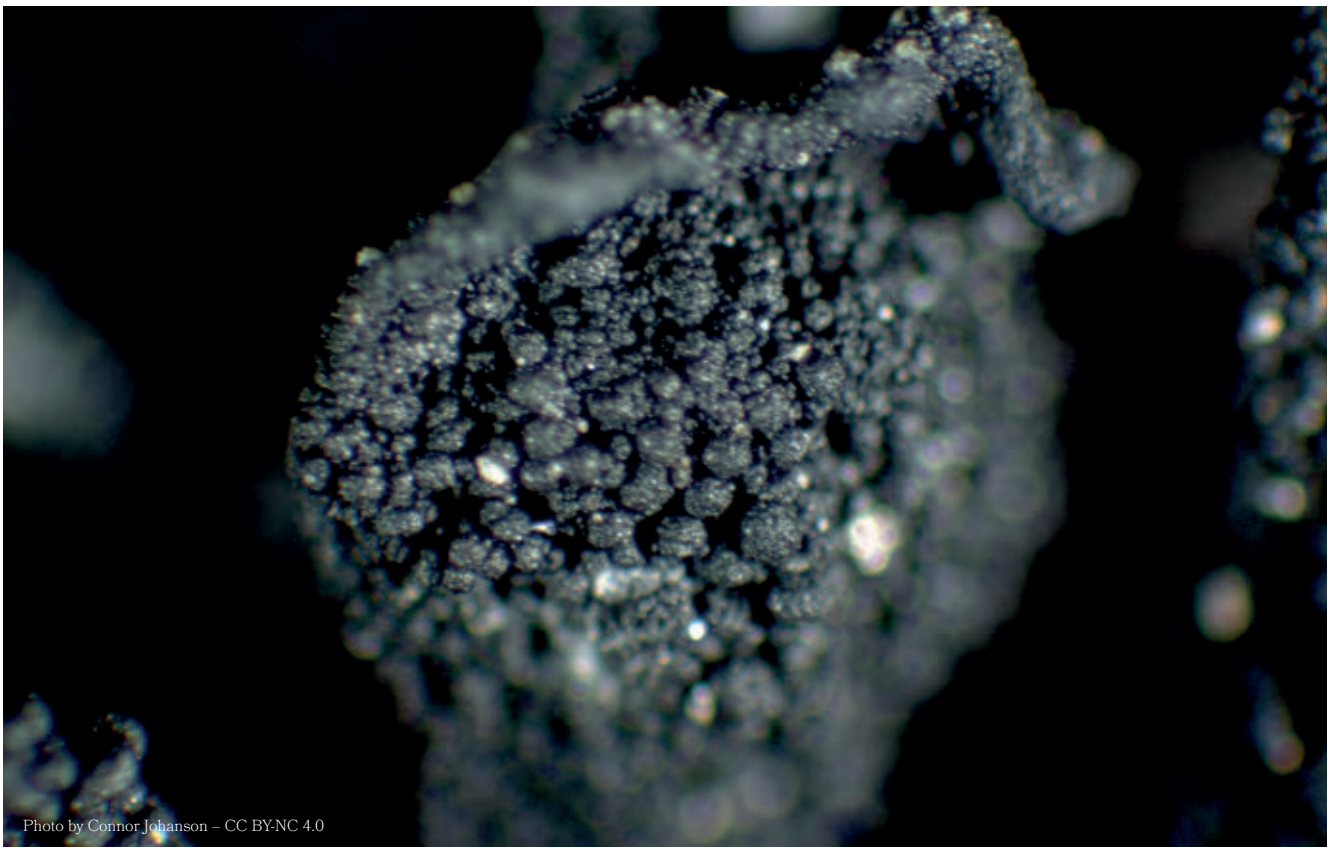
Field notes:

Thallinocarpon nigritellum general view:

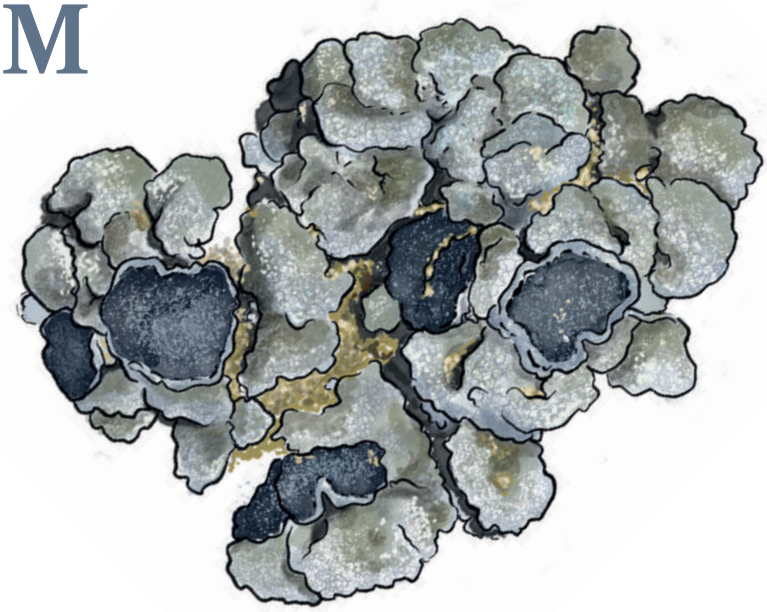


Its tiny black fruiting bodies give it a soot-like appearance on rock surfaces – hence the name nigritellum, meaning “blackened”.

Thallinocarpon nigritellum detail of isidia:



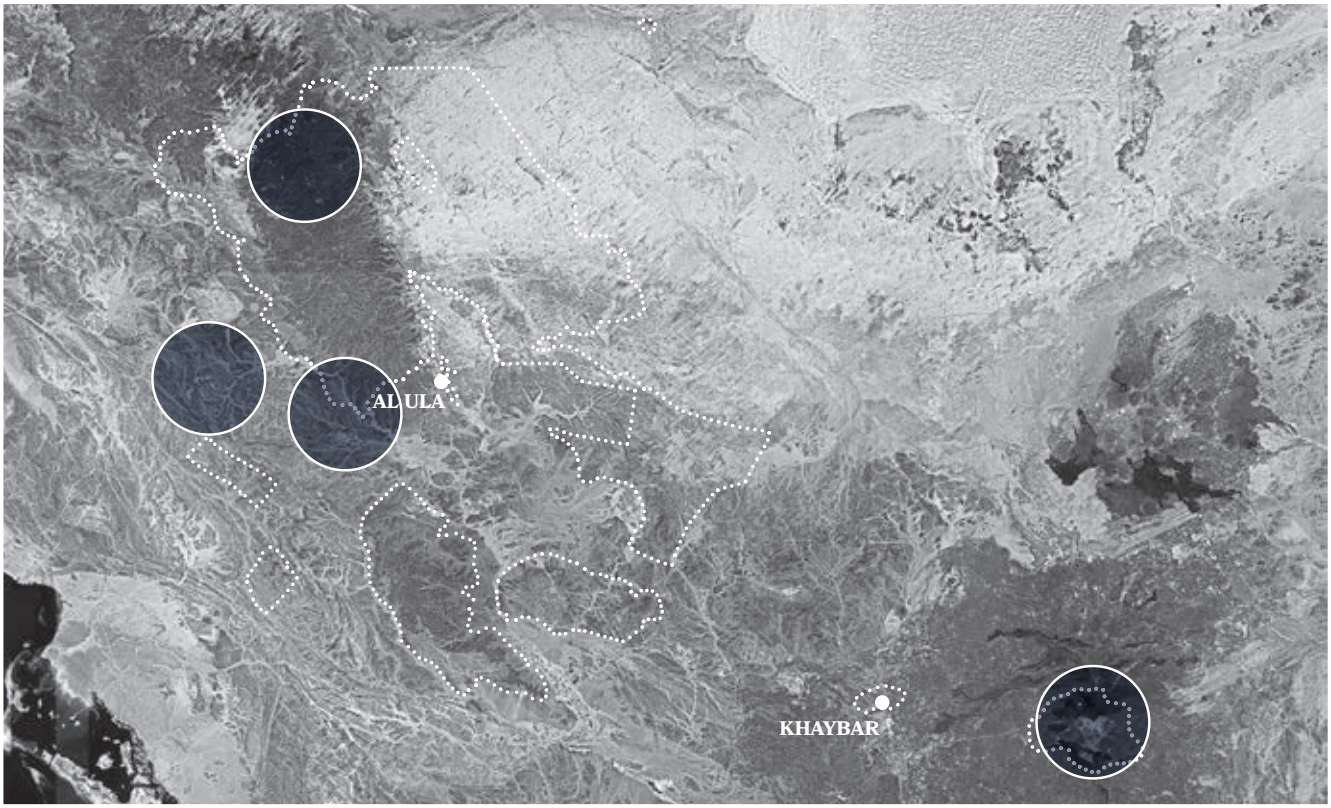
THALLOIDIMA SEDIFOLIUM



Thalloidima Sedifolium
(Scop.) Kistenich, Timdal, Bendiksby & S.Ekman

Description: *Thalloidima sedifolium* is a small terricolous lichen forming compact rosettes of thick, rounded **squamules**. These squamules are smooth, often convex, and have a distinctive pale to greyish-green to olivaceous green tone. The thallus may appear slightly glossy when dry and become softer and more vivid after moisture.

Occurrence in AlUla and Khaybar White Volcano



White dashed lines indicate boundaries of Conservation Areas

THALLOIDIMA SEDIFOLIUM

(Scop.) Kistenich, Timdal, Bendiksby & S.Ekman

Family:
Ramalinaceae

Habitat:
On mud flats and compact gravel in the valleys and inclined slopes of all major geological formations.

Substrate preference:
Terricolous

Growth form:
Squamulose

Photobiont:
Green algae other than Trentepohlia

Reproductive strategy:
Sexual, via apothecia

Commonness-rarity in the region (CRI (1-5)):

☑ **Present in AlUla**
☑ **Present in Khaybar**

Threats:
Mainly human and animal trampling.

Identification tip:
Note the pale green, thick squamules forming low rosettes, showing the subtle central apothecia and the lichen's unique "Toninia green" coloration when dry.

Microhabitat: Mud flats beneath boulder overhangs or compacted soil in rock crevices.

It is typically found on open soil in dry, sunny habitats such as grasslands, steppes, or dry slopes. Its squamules may resemble tiny succulent leaves, remaining close to the substrate. Reproduction is primarily sexual, through blackish apothecia that sometimes form at the centre of older squamules.

Field notes:

Thalloidima sedifolium general view:

This lichen's name comes from its resemblance to Sedum (stonecrop) leaves – tight, plump, and often rising in tiny rosettes on rock.

Thalloidima sedifolium detail of apothecia: