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Short Communication

Usnea cornuta Körb. and *Usnea glabrescens (Vainio) Vainio sens. Lat.*: Species to be protected in the peninsula of Edough (Algeria)

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Abstract: In the Mediterranean region, Edough Peninsula (Algerian Northeast) has a significant procession of rare plant species biogeographical interest. This communication is based on specimens collected by the author during the realization of a lichen herbarium when her attention was attracted by the striking presence of a fruticose lichen of Usnea genus, on a hawthorn at the entrance of a private neglected garden. One of the harvested species proved to be after identification, *Usnea glabrescens* (Vainio) Vainio sens. Lat. A second species was harvested meanwhile a few meters away, on a cork oak and identified as *Usnea cornuta* Körber species ever recorded in Algeria before.

Key words: *Usnea*, Algerian lichen flora, Edough Peninsula, Annaba.

Introduction

Lichens, or lichenised fungi, are part of the fungal kingdom. These organisms are the result of the symbiosis between a fungus, heterotrophic, and autotrophic chlorophyllian partner which is a green algae and/or cyanobacteria (1). The taxonomy of lichens follows the fungal symbionts that are almost always Ascomycetes (99% of cases) and only a few basidiomycetes. The fungus, constituting the bulk of the lichen biomassis about 90% of the dry mass. Algae, represented at 70% by chlorophyllian algae, can often live separately from the presence of the fungal partner. Conversely, only few fungi are known to live without their chlorophyllian partner (2).

The global distribution of lichens, present in a wide variety of habitats from the equator to the poles and from 0 to 8000 m above sea level, allows to qualify them as ubiquitous organisms (2)

The botanical exploration of Algeria was mainly carried out between 1837 and the Second World War, during a particularly fertile period, and continued until independence in 1962. Véla *et al*., 2012 (3) reported that Quézel and Bounaga in1975 wrote, in comparison to areas "well known" or "very well known", which are the majority, "the fairly well known areas correspond to portions of the Tellian Algeria which are difficult to access or paradoxically rarely visited. This is the case of Dahra, Miliana mountains, Kabyle coast of Bibans, Collo, the Edough and especially to the entire region of Calle despite its considerable interest".

The aim of this study was the study, exploration and identification of lichens species in Edough Peninsula. We are particularly interested in two species (*Usnea cornuta Körb* and *Usnea glabrescens (Vainio) Vainio sens. Lat.*) that grow and not inventory before in this area.

Materials and Methods

Study area and collecting site

Edough Peninsulais limited to the north by the Mediterranean Sea. It presents a landscape and a type of active ocean margin structure and houses a floristic of four vegetation series (4): sub-Mediterranean oak zen series, themeso-Mediterranean cork oak series, meso-Mediterranean maritime pine series and thermo-Mediterranean mastic oleo series.

The specimen of *Usnea glabrescens* (Vainio) Vainio sens. Lat. was found in January 2015 on Hawthorn (*Crataegus monogyna)* while the specimen of *Usnea cornuta* Körber was found in February 2015 on cork oak (*Quercus suber*) from Edough Peninsula (Algeria), 742 meters above sea level and 36 ° 55' 33" N and 7 ° 42' 17" E (**figure 1**). The dominant tree species in this part of the forest crop is *Quercus suber.*

Morphological study

The Usnea studied in this work corresponds to spices with erected thallus and without apothecia. Morphology and anatomy were examined under binocular microscope LEICA S8, photographs were taken using Samsung camera. Measurements of the cortex thickness, medulla, and central axis, was performed according to the Clerc method, 1984 (5) which comprises a longitudinal cut in the thickest part of a primary branch using a razorblade (**figure 2**). Measures were done with a digital microscope camera (under magnification 38X). The following parameters was calculated:

A: The measurements of the central axis

B: The measurements of the branch

$(c1 + c2) / 2 = C$ $(m1 + m2) / 2 = M$ $A + 2M + 2C = B$

$\%C = (C/B) \times 100$ $\%M = (M/B) \times 100$ $\%A = (A/B) \times 100$

These measurements were repeated on 2 or 3 different locations on the same branch, to avoid damaging the sample.

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Figure 1. Localization of the study and collecting site in Edough Peninsula (North East of Algeria). ★ : Study area.

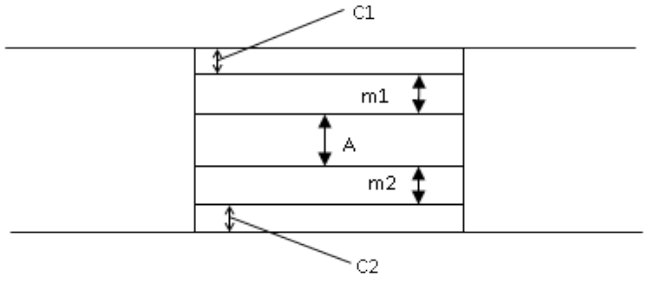

Figure 2. Longitudinal cut in the thickest part of a primary branch for measurements of the thickness of the cortex, the medulla, and the central axis (5).

Results and Discussion

Recognition of the genus *Usnea* is easy due on the typical morphology of the lichen fruticose, and the presence of a central axis, however, identification of species is much more complicated because of the variability in both morphology and chemistry of taxa (6).

Usnea cornuta Körb.

Usnea cornuta Körber, lichen common on conifers and hardwoods (7) was collected on a cork oak in the Peninsula of Edough. The morphological and anatomical key characteristics used for identification are listed on **table 1.**

The ramifications are often widely divergent giving the thallus a broadly bushy appearance (**figure 3F**). We observed that the lateral branches are more or less articulated with distinct annular cracks (**figure 3 D&H**) with excretion of calcium oxalate, in agreement with descriptions of Gavériaux (8) and Halonen *et al.*, 1998 (9) works and different types of circular fractures described by Clerc (1984).

In Europe, *Usnea flammea* is often confused with *Usnea cornuta*, a spice with which it often grows at the same site. However, Usnea cornuta has lateral branches that are distinctly constricted at ramification points (5), character observed on our samples (**figure 3D**), confirmed that we are in possession of *Usnea cornuta.*

Regarding the fibrils and the spinules, they are sparse and perpendicular to the ramification (**figure 3B**) and present only on their base. It was noted that the fibrils and branches are often more or less inflated as reported by Halonen *et al.*, 1998 (9).

It has been observed (**figure 3G**) an uncommon papillae: conical papillae (see different forms of papillae described by Clerc (5)) on the base of main branches; like noted by Mc Cune (7).

On small soralia, we note that the isidia appears to precede the formation of soredia like reported by McCune, 2005(7). We also observed numerous and punctiform soralia according to other literatures (10,11). Those soralia becoming isidiomorphs, round and ever

Table 1. Morphological and anatomical characteristics of U*snea cornuta* Körb.

Characteristics	Descriptions
Thallus	- Shrubby - Olive green
Ramification and Branches	- Divergent ramification - Lateral branches with distinct annular cracks
Attachment point and Base	- Black attachment point - Blackened base without cracks
Fibrils	Fibrils and spinules : sparse and +/- inflates
Isidia	Isidia on small soralia
Soralia	- Numerous punctiform soralia - Isidiomorphs soralia - Coaliscing soralia into larger patches
Papillae	Conical papillae on main branches
Cortex	Glossy and thin cortex: (7-8%)
Medulla	White and thick medulla: (24-28%)
Central Axis	Thick central axis: (30-33%)

Figure 3. ***Usnea cornuta*** **Körber.A**: Base without cracks, **B**: Fibrils, **C**: Base of thallus, **D**: Lateral branches with soralia, **E**: Branch with medulla, **F**: Thallus, **G**: Papillae; **H**: Lateral branch with fibrils.

small (less than half the branch diameter), but sometimes coalescing into larger patches (**figure 3D**) near the apices of branches and fibrils as described by Van Haluwyn *et al*., 2013 (10).

Comparison of the thickness of the inner layers of branches is a widely used anatomical character which has been consistently applied (6).

As shown in figure 3E, we observed a glossy and thin cortex, similar observation was reported by Clerc (11). The thickness of the cortex is (7- 9%). Halonen *et al*. (9) report that the thickness of the cortex of *Usnea cornuta* is between 3 and 9%. The medulla is white and thick (24- 28%). And for the central axis, it is thick (30-33%).

Usnea glabrescens **(Vainio) Vainio sens. Lat.**

Morphological and anatomical characteristics which helped to identify the Usnea species are listed on **table 2**.

The sample is juvenile, a length of several centimeters (**figure 4E**), found on the bark of *Crataegus monogyna* with another unidentified specimens of the same genus *Usnea*. The thallus is olive-green, tufty and shrubby. The ramification is isotomic-dichotomious. The branches of *Usnea glabrescens* are not swollen but cylindrical (**figure 4F**) as reported by McCune, 2005 (7). Lateral branches and fibrils are more divergent.

Concerning the attachment point, it is distinctly black. The base is conspicuously blackened, we also observed annular cracks with white medullary rings (**figure 4A**) as was noted in Lukáč on his sample of *Usnea glabrescens* (12).

Characters of soralia are essentials for the shrubby species like *Usnea glabrescens*, and both young and mature soralia should be considered (6). We note punctiform young soralia, not isidiate, later becoming larger but usually staying distinctly rounded (**figure 4B**)

As reported by Gavériaux, 2010 (13) and Lukáč, 2010 (12), we observed the papillae of *Usnea glabrescens* only on main branches (**figure 4D**).

As for the first species studied, we compared the thickness of the inner layers of branches: The cortex is shiny and rather thick (**figure 4C**). The thickness of the cortex, measured as a percentage according to the Clerc method described above (5), is between (12.5-15%); Lukáč found that it is relatively thick (10-14%) (12). The color of the medulla is an easily observed character in longitudinal sections of branches (figure 4C). The medulla of *Usnea glabrescens* is white, dense with agglutinated and individually visible hyphae (15- 18%). The same proportions have been obtained by Lukáč (12).

Regarding the central axis, it is light pink (figure 4C). Torra and Randlane (2007) explain this diagnostic character by the presence of an unidentified pink pigment (6). The thickness of the central axis is between (33-40%). Mc Cune,2005 reported that the diameter of the central axis of *Usnea glabrescens* is 36% (7) while LUKÁČ, 2010 (12) note that it is between 38 and 44%. However, Gavériaux found that the axial cord of *Usnea glabrescens* is thicker and varies between 36 and 52% (13).

The lichen species accompanying *Usnea glabrescens* (Vainio) Vainio sens. Lat. On the bark of *Cratae-*

Table 2. Morphological and anatomical characteristics of *Usnea glabrescens* (Vainio) Vainio sens. Lat.

Characteristics	Descriptions
Thallus	Shrubby
Ramification and Branches	- Isotomic-dichotomious - Branches not swollen, and more divergent
Attachment point and Base	- Black attachment point - Base blackened with transverse annular cracks
Fibrils	- Present on the basal parts - Sparse or absent on apical parts
Isidia	Not observed
Soralia	Punctiform young soralia
Papillae	Present only on main branches
Cortex	- Shiny cortex - Rather thick (12.5- 15%)
Medulla	- White and dense medulla - The thickness is between (15-18%)
Central Axis	- Light pink - The thickness is between (30-40%)

Figure 3. ***Usnea glabrescens*** **(Vainio) Vainio sens. Lat. A**: Attachment point and base of thallus; **B**: Apical branch with soralia; **C**: Branch with medulla; **D**: Soralia and papillae on main branch; **E**: Thallus; **F**: Transverse section.

gus monogyna:

- *Anaptychia cilliaris* (L.) Körb.
- *Evernia prunastri* (L.) Ach.
- *Lecanora chloroterra* Nyl.
- *Lepraria incana* (L.) Ach.
- *Ochrolechia turneri* (Sm.) Hasselr
- *Ochrolechia parella* (L.) Massal.
- *Parmotrema perlatum* (Huds.) M. Choisy
- *Pertusaria amara* (Ach.) Nyl.
- *Physcia aipolia* (Ehrh. ex Humb.) Furhr.*Physcia leptalea* (Ach.) Dc.
- *Phlyctis argena* (Spreng.) Elix & Lumbsch
- *Punctelia borreri* (Sm.) Krog
- *Ramalina calicaris* (L.) Röhl.
- *Ramalina canariensis* J.Steiner
- *Ramalina farinacea* (L.) ach.
- *Ramalina fastigiata* (Pers.) Ach.
- *Ramalina fraxinea* (L.) Ach.
- *Teloschistes chrysophtalmus* (L.) Th. Fr.
- *Xanthoria parietina (*L.) Th. Fr.

Conclusion

Usnea ssp. can be found covering many trees, in the forested mountain regions, growing abundantly in wet climates. However, in the Peninsula of the Edough, *Usnea* ssp. is hardly noticed, because it grows timidly among other fruticulous lichens as *Ramalina* ssp., forming tiny tufts of few centimeters.

The genus *Usnea* is part of uncultivated plant species protected in Algeria, in this study we report for the first time the presence of *Usnea cornuta Körber* and *Usnea glabrescens* (Vainio) Vainio sens. Lat.in Edough Peninsula, species which presence has never been re-

ported before, according to literature and listed lichens of Algeria performed by Ait Hamou *et al*., 2014 (14).

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