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## Revealing the taxonomy of an endemic oak of Lebanon

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### Abstract

The taxonomy of oaks in Lebanon relies on the works of Mouterde (1966). Since half a century, there were no taxonomic revision for these species, namely for *Quercus pinnatifida* Gmelin, which is no more in use worldwide after successive nomenclature revisions. This name was replaced by *Quercus pubescens* Willd. subsp. *pubescens* which has never been recorded in Lebanon. However, *Quercus kotschyana* O. Schwarz is cited as an endemic species of Lebanon, but it was never mentioned by Mouterde works, nor by the literature that followed (i.e. Abi Saleh, 1976, 1996; Menitsky, 2005; Tohme & Tohme, 2014). This work aims at revealing the taxonomy of an endemic oak of Lebanon, and clarify the existing confusion in the nomenclature of species. The comparison of collected plant material from different sites, with the holotype of *Quercus kotschyana*, and the botanical description and drawings found in the literature, allowed us to conclude that *Quercus pinnatifida* Gmel. was wrongly attributed to the taxon found in Lebanon, and that the actual present species is *Quercus kotschyana* O. Schwarz.

Key words: Lebanon, *Quercus kotschyana*, *Quercus pubescens*, *Quercus pinnatifida*, taxonomy.

### Introduction

The flora of Lebanon relies on the works of Mouterde who elaborated an exhaustive inventory of flora for Lebanon and Syria (Mouterde, 1966). Amongst the cited oak species, the author mentions *Quercus pinnatifida* Gmelin and provides the synonym *Quercus lanuginosa* Willd. var. *pinnatifida* (C.C. Gmel.). However, this taxon, was initially described in Germany from a single individual, bearing no fruits, and considered as a variety of *Quercus lanuginosa* (Mouterde, 1966; Gmelin, 1826). Moreover, Abi Saleh *et al.* (1996), then Tohme & Tohme (2014), do not go in-depth in the taxonomy of the species, and follow the same nomenclature and describe the presence of *Quercus pinnatifida* in Lebanon, on the western slopes of northern Mount Lebanon (in the following locations: Danniyeh, Ehden, cedars of Bsherre, Tannourine cedars, and Khan Sannine). The habitat corresponds to the Mediterranean montane and Supra Mediterranean vegetation stages. The species is associated to the cedar vegetation series (Abi Saleh *et al.* 1976).

Nonetheless, *Quercus pinnatifida* was forgotten due to several recombination and nomenclature revision as noted by Bussotti & Grossoni (1998). According to Govaerts & Frodin (1998), *Quercus pinnatifida* is no more in use, and is considered as a synonym of *Quercus pubescens* Willd. subsp. *pubescens*, a subspecies of *Quercus pubescens* (Willdenow, 1805) present in Europe and Turkey but never mentioned in Lebanon (Roskov *et al.*, 2015).

In a different context, the IPNI cites *Quercus kotschyana* O. Schwarz as an oak species of Lebanon. It was

initially named by Kotschy *Quercus tauzin*, a synonym of *Quercus pyrenaica* Willd. (Willdenow, 1805; Kotschy, 1862; Schwarz, 1935). Govaerts & Frodin (1998) quote it as a probable hybrid of *Quercus pubescens* and *Quercus cerris* L. with a certain similitude with *Quercus vulcanica* Boiss. & Heldr. ex Kotschy. The red list of oaks cites *Quercus kotschyana* as an endemic species to Lebanon that requires assessment, and stresses out the lack of information about this species (Eastwood & Oldfield, 2007). Nonetheless, *Quercus kotschyana* is not mentioned by Mouterde (1966), Tohme & Tohme (2014) or Menitsky (2005). According to Bussotti & Grossoni (1998), it was cited by Camus (1930–1936) under his list of European and Mediterranean oaks, under the *Quercus* L. subgenus, *Quercus* section (*Lepidobalanus* Endl.), as a species endemic to Lebanon.

Subsequently, the objective of this communication is to clarify the following questions:

- i) Is *Quercus pubescens* subsp. *pubescens* present in Lebanon, or is it *Quercus kotschyana*?
- ii) Are there two different species, or is there a certain confusion in the taxonomy?

### Material and methods

The analysis relied on both taxonomic revision using the botanical description of species and the respective provided drawings, from different references namely:

The scanned holotype of the material of *Quercus kotschyana* (i.e. the holotype [Schwarz, 1935] —LEBANON, Bsherre: near cedars, 28 July, 1855, S-G-5164 (S!)) that was provided by the Natural History Museum

of Sweden and (Schwartz (1935) the botanical description and illustrations of *Quercus kotschyana* from Schwarz (1935).

The botanical description and illustrations of *Quercus pinnatifida* from Mouterde (1966).

Assuming that *Quercus pinnatifida* is a synonym of *Quercus pubescens* subsp. *pubescens*, as previously mentioned, we compared the botanical description of both *taxa* with each other and further with *Quercus kotschyana*.

In October 2015 we conducted a field survey to sample leaves and fruits of this *taxon* (under both nominations of *Quercus pinnatifida* and *Quercus kotschyana*) in order to compare them with the holotype and drawings, and with their area of distribution with the literature, including the sites mentioned by Schwartz (1935), Mouterde (1966) and Tohme & Tohme (2014).

In Figures 1 and 2 we show respectively, the holotype scanned leaves and the leaves of the collected material.

## Results and discussion

In regard to *Quercus pinnatifida* found in Lebanon, Mouterde (1966) described it as close to *Quercus cerris* and *Quercus cedrorum* Kotschy: “very close to *Quercus cedrorum*, leaf lobes often slightly sharp and very shortly mucronate, often themselves lobules-dentate, separated from each other by deep sinuses, which often enter until very near the midrib itself (remininding those of *Quercus cerris*). Leaves are polymorph, hairless or glabrescent at maturity, but strongly pubes-

cent when young. Branches are often fairly bright red. Acorns very similar to those of *Quercus cedrorum* that can also achieve strong growth”. Moreover, the author described the acorns of *Quercus cedrorum*: “Cupule with appressed scales, gray, strongly exceeding the acorns which can be very large”.

In the Flora of Turkey (Hedge & Yaltirik, 2008), *Quercus pubescens* leaves are described as “most variable but generally oblong-obovate, greyish green above, brownish gray beneath, asymmetrically subcordate or rounded, thick-textured, with 3-6 strongly undulate forwardly-pointing irregular acute lobes with revolute margins; indumentum densely to thinly stellate-tomentose beneath, with many scattered minute stellate hairs above”. As for the fruits, they are described as “cupule shallow to 15 mm diameter; scales appressed, lanceolate, pubescent, brownish-grey; acorn 2/3 exerted”. The authors cited that the typical form of this *taxon* is characterized by “short petioles, and undulate-margined, lobed, greyish leaves. These persist on the trees in a dried state over winter”.

*Quercus pubescens* is part of the Mediterranean evergreen coppice in Europe, while in Turkey it makes part of steppic or semi-steppic vegetation of Anatolia, at an elevation reaching 1700 m (Hedge & Yaltirik, 2008). However, this species and its associated vegetation series are not found in the Lebanese flora.

Drawings of leaves of both *taxa*, in those two respective references show large discrepancy.

In respect to *Quercus kotschyana*, the leaves are “moderate or small, with remotely inserted stipules,



Fig. 1 - The scanned leaves of *Quercus kotschyana* holotype from the National History Museum, Sweden.



Fig. 2 - The scanned leaves of *Quercus kotschyana* collected from Bsherre in October 2015.

glabrous, soon deciduous, petiolate or sub-sessile". Petioles are "slender, 1.5-2.7 cm long, non-channeled and with stellate hairs". The blade is "strongly leath-ered, 6-12 cm long, 3.2-6.5 cm wide, round-oval to oblong lanceolate, a little above the base, sinuses are narrow acute cutting almost down to the to the mid-rib. Lobes are broadly linear, acuminate, with distinct sinuate margins". Fruits are "in peduncles 1.5-5 cm long, thick, tomentose, crammed in short racemes 2-6, at the axis of the apical leaves. The cupule is hemi-ellipsoidal with frequent scales dense gray-tomentose linear-lanceolate" (Schwarz, 1935). Additional loca-tions where the *taxon* is found, were also cited: "Dan-niye above Floa valley, above Ehden, at an elevation of 5,000 feet" (above 1,500 m).

The description and illustrations of *Quercus kotschy-ana* as provided by Schwarz (1935) as well as the scanned holotype kindly provided by the Natural His-tory Museum of Sweden match with *Quercus pinnati-fida* as described and drawn by Mouterde (1966), while showing a large discrepancy with those of *Quercus pu-bescens*.

We compared the botanical description and drawings of *Quercus kotschyana* with those of *Quercus vulcan-ica*, and found that they are different. This conclusion converges with Jablonski (2016) who cites that the lat-ter species is different from *Quercus kotschyana* found in Lebanon.

Moreover, the locations of the collected material as mentioned in the consulted holotype and by Schwarz (1935) converge with those mentioned by Mouterde (1966) and Tohme & Tohme (2014), in sites where only one oak *taxon* is present (i.e. in Bsharre, near the cedars, where the holotype is collected from).

Additional sites were identified (Arz Jaj, Jord Aqou-ra, and Jord Afqa). Initial results confirmed the botani-cal description, the area of distribution as well as the presence of one single species that is *Quercus kotschy-ana*, namely from Bsharre where the holotype was col-lected from (Schwarz, 1935).

## Conclusions

Based on the above, the *taxon* found in Lebanon can-not be attributed to *Quercus pubescens* found in Tur-key and Europe, as their area of distribution are not the same, their habitat is different, as it occurs in Lebanon between 1,500 and 2,000 m in more sub-humid condi-tions, and in association with a different set of species that are more adapted to sub-humid conditions (Stephan *et al.*, 2016; Abi Saleh *et al.*, 1996; Mouterde, 1966). Whereas *Quercus pubescens* is more distrib-uted into different bioclimatic zones. Moreover, leaf and cupule description show a certain discrepancy between both species, namely the deep sinuses and feathery upper blade of the Lebanese *taxon*, and the

thick-textured blade and hairy beneath with forwardly-pointing irregular acute lobes of *Quercus pubescens* (Govaerts & Frodin, 1998; Menitsky, 2005; Hedge & Yaltirik, 2008).

These results show with clearness that *Quercus pin-natifida* Gmel. was wrongly attributed to the *taxon* found in Lebanon, and that the actual present species is *Quercus kotschyana* O. Schwarz. Further in-depth morphometric and molecular analysis will be conduct-ed to characterize this endemic oak of Lebanon, and conduct the IUCN red listing assessment and a sound action plan for its conservation.

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