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Phytogeography, population, habitat, ecology, threat and conservation action of *Orchis anatolica* Boiss. in Lebanon

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ABSTRACT

This publication examines the phytogeographical distribution of *Orchis anatolica* Boiss. in Lebanon. It is one of the Mediterranean orchid species which has a wide prevalence throughout the country. For the first time in the botanical history of the country, a phytogeographical survey is scrutinized for this species that has lasted for 21 years of fieldwork. Two hundred twenty-seven locations except those that are dangerous to reach all over the country are approved to contain this marvelous beautiful orchid. The result of this phytogeographical survey reveals that this orchid is common in Lebanon and not endangered as it is in some neighboring countries.

Introduction

The family of Orchidaceae is recognized as the largest flowering plant of angiosperms. This species counts range from 17500 to 35000 approximately and well documented reports estimate 20,000 (Addam et al, 2015). Orchids are one of the neatest and most beautiful plants let alone their fragrance; some smell so sweet and others smell like rotten meat (Levesque & Levesque, 2008).

A diversity which few family plants match, orchids exhibit a wide diversity of epiphytic and terrestrial plants that are found all over the world and can adapt to different kind of habitats (Schatz et al., 2016). Their distribution ranges from desert and semi-scrub, rain and cloud forests, to tundra ecosystems. They also exhibit a wide variety of unique morphological and anatomical adaptations. Though coupled with their popularity worldwide, the ecological complexity inspires urgency for orchids' conservation while the pressure on the natural environment increases per day (Swartz et al., 2009).

Though recognized as a global center of plant diversity, the Mediterranean basin reserves many unique and endemic native orchids. Its biodiversity comprises more than 2 million square kilometers as it covers the second of the largest hotspot in the world and the largest of the five Mediterranean climate worldwide regions (Addam et al., 2017 b). Moreover, in terms of plant diversity, the Mediterranean basin is the third richest hotspot worldwide. Though many species are being discovered each year, around 30,000 ensue, and more than 13,000 species are not found anywhere else or endemic to the hotspot (Plant life, 2004)

Lebanon lies in the Levantine uplands, which is located in the East Mediterranean and considered as a recognized center of this plant diversity. It is one of the unique countries due to its small size and exceptionally high percentage of its native flora. Its distance from the north and the south of the country is 180 km and 50 km from east to west. Lebanon is characterized by its typical climate, geological up-bringing and topographical diversity (Addam et al., 2017b).

These factors portray this country as an essential reserve for many sporadic, native and endemic species and are known as one of the most remarkable spots of conservation. It is also known as a mini-hotspot which shelters high biodiversity richness especially Orchids. It consists of two mountain ranges: The Mount Lebanon and Anti-Lebanon Chains with 73% of the total mountainous area where most orchids grow (Sattout, 2007; Myers, 1990).

Mount Lebanon is one of the "regional hotspots" (Addam et al, 2016a, 2017a) whereby 85% of orchids are found during our 21 years of field work. The orchids discovered by K. Addam and

M. Bou-Hamdan comprise the immense presence of the *Orchis anatolica* in addition to the very rare three members of its family (*O. sitiaca*, *O. troodi* and *O. anatolica* subsp. albiflora Subsp. Novo *K. Addam & M. Bou-Hamdan*) and many others which are present in our publications (Addam et al., 2017a, 2017b, 2016a, 2016b, 2015a, 2015b, 2014, 2013).

Among new species of the orchid's family that are also discovered and published by K. Addam and M. Bou-Hamdan are new records (11 subspecies & varieties) (Addam et al, 2015a, 2016b, 2017b), new endemic world records (5 species & subspecies) (Addam et al, 2013, 2014, 2015b, 2017b) and (2 new cyclamens from the Primulaceae family (Addam et al, 2016a, 2017a), while 70 from the Orchidaceae family and about 300 from other families are found and identified whereby they are being published soon.

Orchidaceae, more than any other plant family, has a high proportion of threatened genera, with most containing threatened species (Mittermeier et al., 2005) especially in Lebanon. The relative infrequency of orchids is affected mainly by the geographical distribution, habitat specificity, and population size. Thus, the smaller the geographical distribution and population size and the more specific its habitat preferences are, the rarer the species (Hágsater & Dumont, 1999).

Many scientists who worked on the Lebanese flora (Tohme and Tohme, 2014; Haber and Haber, 2009; Mouterde, 1983; Post and Dinsmore, 1932), particularly the Lebanese Orchidaceae family, had different statistical findings and mentioned the existence of Orchis anatolica in their books, starting from Post (1896) and ending with Tohme (2014) etc. However, only Dr. Addam and M. Bou-Hamdan (2017) added 3 new species to the *O. anatolica* family (Addam et al., 2017b). It is obvious that the nomenclatures and specifications of some species as well as the classifications of other families are not accepted anymore (The Plant List, 2013) in some old books (Haber and Haber, 2009; Mouterde, 1983). These books contain some outdated information (Post and Dinsmore, 1932; Mouterde, 1983) whereby the existence of other new members and varieties related to this species are not mentioned.

These scientists mentioned some species that are considered now as new ones but recognized them as one species, which is clear in their morphological descriptions and taxonomy in their books. Since then, a lot of discoveries were made in the field of Orchidology with the advancement in technology whether in the fields of genetics or pollination. For instance, some scientists mentioned that we have *Ophrys fusca* in Lebanon, but according to the new classifications, we don't have any of this species. 99% of this group that was recognized by them as *fusca* is documented now as *Ophrys omegaifera* and its subspecies in Lebanon. Nowadays, new classification of this *Ophrys omegaifera* is present which leads to the discovery of new species and new world records (Addam et al, 2013). Regardless, many information found in these books, whether or not they are widely accepted, are still considered as very significant references for many publications. Their importance lies in providing perspectives on the species, classifications, generic concepts and many extinct and still valid nomenclatures currently employed in orchid systematics of the Lebanese flora (Zahreddine, 2005). All the aforementioned scientists who worked on the Lebanese flora, specifically the Orchidaceae family, didn't give importance for their broad phytogeographical scope and stressed only on their presence in 2 or 3 places (rarely reaching 6). This is because their aim of the plants' locations is to prove that they exist in Lebanon even though they found them in hundreds of places. But nobody, including us, had previously made a specific phytogeography for every species of orchids all over Lebanon before the year of 2015.

Orchis anatolica Boiss. is a spectacular species and was first described by Edmond Boissier in 1844 (Fig. 1; Altundag et al., 2012). It is 10-45cm tall; reddish-brown stem; 3-6 rosette dark green spotted violet (sometimes are not spoted) oblong to lanceolate basal leaves, reddish bracts pointed at the tip and almostly as long as ovary; lax inflorescence, 2-17 flowers (up to 25), deep purple, pale pink to violet, rarely white, petals are slightly concave: sepals oval to lanceolate elongated, veined, forming a hood with the petals, lip 3-lobed 7-13mm x 8-13mm, convex center, grooved, lateral lobes often curved forward, broad; median lobe near rhomboidal Fig. 1. It has been phytogeographically recorded in various countries such as Greece, Cyprus, Lebanon, North Iraq, Northwest Iran, Turkey, East Aegean islands (Renz & Taubenheim, 1984), Palestine, Kriti, Syria and Jordan (Kew Gardens, 2010). It is a Mediterranean orchid that is considered to be threatened due to many causes that will be further discussed.

Phytogeography is a division of botany which deals with the geographical distribution of plants. In the 19th century, many scientists began to focus on this topic. Early plant geographers did not only describe floras but also endeavored to divide earth into floristic and botanical zones (Britannica, 2018; Collins Dictionary, 2018).

Fig 1. *Orchis anatolica* Boiss.

In Lebanon, *Orchis anatolic*a has a wide distribution and is common unlike several neighboring countries such as Syria, Palestine, Jordan and even Turkey whereby it is considered threatened, endangered and even extinct (Addam et al., 2017b, Taifour, 2012, Haider et al, 2012, Altundag et al., 2012). The information found in many publications performed on the phytogeography and the status of these species left us confused and stun (Addam et al., 2017b). How come *Orchis anatolica* is threatened and endangered in all the Lebanese neighboring countries while its thorough existence is roughly recognized all over Lebanon during our 21 years of field work?

This observation motivated us to study the phytogeography of *Orchis anatolica* in 2015. We started to search for its location through the data we collected as pictures and notes gathered and through a concentrated field work of observation and documentation for the new places and the names of villages that were either identified or unidentified that lasted for a period of 21 years. During this campaign of finding the locations of Orchis anatolica all over Lebanon, we started to undergo the same process for other orchids that grew near it and this led us to a very important evidence in the history of orchids in Lebanon.

A decision was made to start a huge challenging project: the phytogeography of all the Lebanese orchids starting with *Orchis anatolica*. So again, we searched in the collected data that we have gathered for these years. We picked all the places for the entire orchids that we found in Lebanon while searching for new places since 2015. Though many obstacles faced this enormous phytogeographical venture of the Orchideaceae family, we were and are still up to these challenges. The objectives of this phytogeographical study are to assess the spatial distribution *of O. anatolica's* richness in Lebanon as well as to contribute and develop its effective conservation strategies.

Materials and Methods

The main goal of this study is to assess the spatial distribution of *Orchis anatolica's* richness, phytogeographical localization and regionalization in Lebanon. Hence, we compiled a data set of present records from *Orchis anatolica's* collections within our study area, which contained most of the parts that can be reached safely in this country. An extended process was performed in collecting this information. The first was in 1997, whereby the data of longitude and altitude was registered on system A GPS Garmin Nuvi Fig. 2 (Shashinki, 2018) and the second was recorded on system B GPS Garmin Oregon 550 Fig. 3 (Buy Garmin, 2018). Some of the information of locations was recognized on mobile phones, initially Samsung mobile, followed by LG and finally iPhone which proved more accuracy among all the utilized phones. Finally, we resorted to the archive of pictures to detect where the previously discovered or found orchids are sited through a fieldwork that lasted till 2017.

In order to track the orchid species in the Lebanese region, the IT department at Arts, Sciences and Technology University in Lebanon (AUL) managed by Dr. Jihad Itani and Eng. Khaled Jamal Eddine, developed a system that sought to record the longitude and altitude of several regions all over Lebanon. This system used technological and geographical information to determine the location of each *Orchis anatolica* discovered by Dr. Addam and M. Bou-Hamdan. Afterwards, they collected the information retrieved by the team from the latitude, longitude and elevation of each region to record the *O. anatolica's* frequency in each Fig. 4. Then, they determined and placed the specimens that were collected and identified by Dr. Addam and M. Bou-Hamdan in the program.

Subsequently, this system is developed and a web application is integrated with Google maps to store all this compiled information on the computer at K Addam's herbarium in AUL. This system realizes some useful functions, such as map operation, data management, monitoring and reporting.

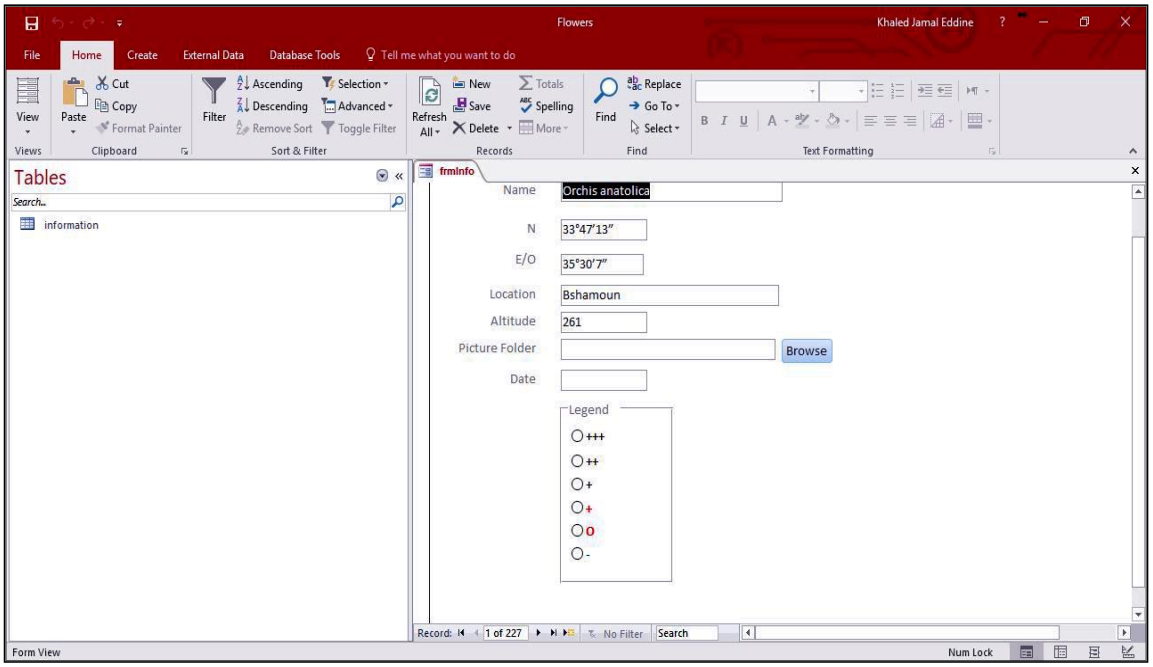
In addition to this system, we have another one, which is also launched by the IT at AUL to be utilized at K. Addam's Herbarium. The herbarium's system detects the names and family names, specimens, holotypes, descriptions, significance, locations (latitude, longitude, elevation, and map), habitats, images, as well as self-info of the Lebanese flora (including orchids) Fig. 5a.

Both systems are complementary for the projects: "Orchids of Lebanon", "Conservation of Lebanese Flora" and "New World Records of Orchids in Lebanon" as disclosed in Research Gate (Researchgate, 2018). These projects are being studied by the Integrative and Environmental Research Center at AUL.

The voucher specimen (representative dried sample) of *O. anatolica* Fig. 5b is deposited in K. Addam's Herbarium at Arts, Sciences and Technology University in Lebanon collected by Dr. Addam at 14/IV/2017 and of collection number (14-04-17-78-001). The deposited herbarium material was recognized, scrutinized and recorded as a matter of its distribution.

Fig 2. GPS A Garmin Nuvi (Shashinki, 2008)

Fig 3. GPS B Garmin Oregon 550 (Buy Garmin, 2018)



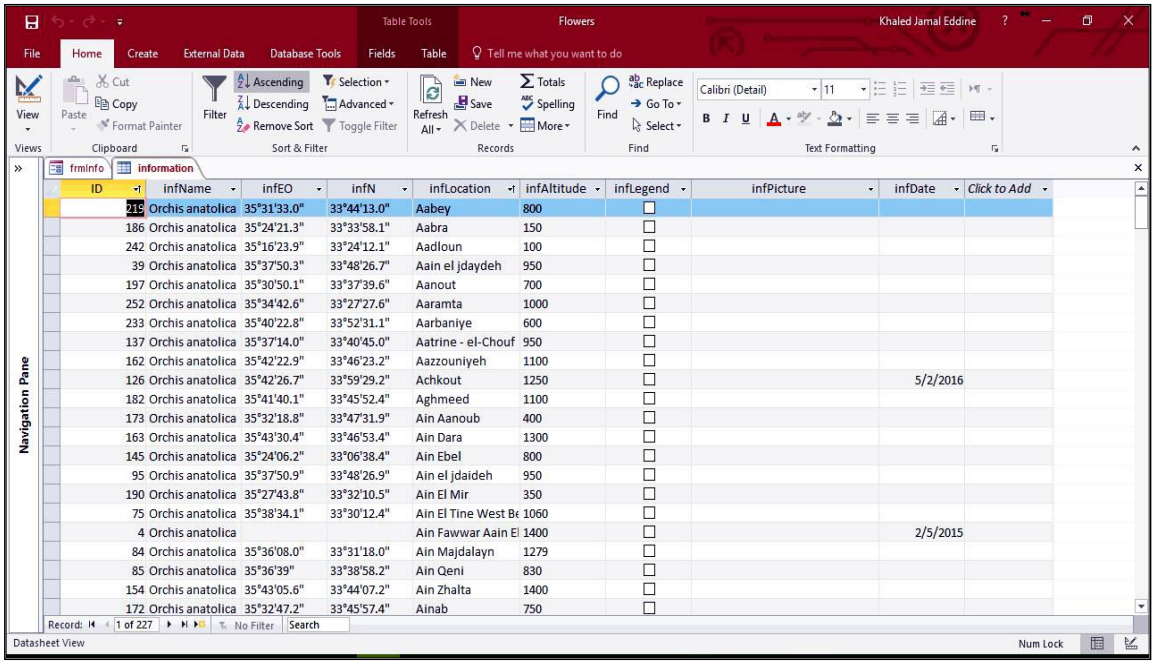


Fig 4. A Screenshot of the Computer System Showing the Latitude, Longitude, Frequency and Elevation of Lebanese Regions in Recording *O. anatolica*

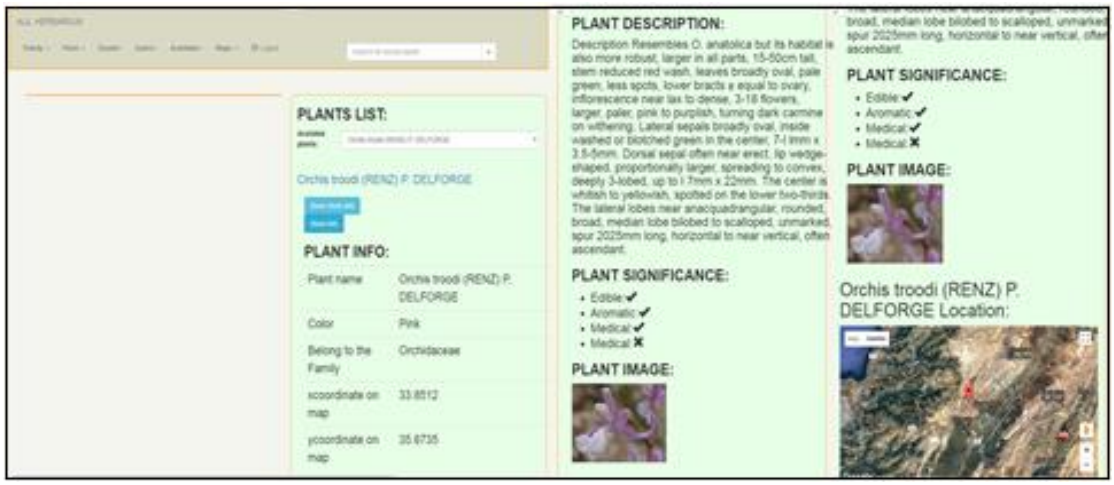


Fig. 5a. Screenshot of K. Addam's Herbarium System

Fig. 5b. The Dried Specimen of *O. anatolica* in K. Addam Herbarium. All pictures in the research are captured by Dr. K. Addam, M. Bou-Hamdan and Ms. Mariam Yasmina Alameh .

Results

In this study, the phytogeographical distribution of *Orchis anatolica* in Lebanon is examined. A phytogeographical survey is inspected for this species that lasted for a period that surpasses twenty years of fieldwork. Two hundred twenty-seven locations except those that are dangerous to reach all over the country are approved to contain this marvelous beautiful orchid (Fig. 6; Table 1). Most of these locations (≃85%) are found in the region of Mount Lebanon, (≃12%) in North Lebanon and (≃3%) in South Lebanon (Fig. 7; Table 1). The frequency of the orchids' growth is measured with respect to the locations found within a certain village, (the location's measurements are for a patch of a certain village they were found in whereby it is considered as our reference for the detection of *anatolica's* frequency). This is one of many other locations that might exist in the same village named in the system. The frequency of *anatolica* respectively shows 65% which proves high frequency of growth (200>), 30% which indicates a moderate frequency of growth (20-100) and 5% which designates a very low frequency of growth (<10) in Fig. 8. An elevation of (1-100m) displays 3.3% and that of (100-500m) reveals 21.3%. Also, an elevation of (500-1000m) indicates 42.7%, that of (1000-1500m) shows 27.9 % and elevation of (1500m>) designates 4.1% (Fig. 9).

Many worldwide species of the Orchidaceae family are being driven to extinction. This family demonstrates a wide variety of unique morphological and anatomical adaptations with wide-ranging distributions. This ecological complexity, coupled with their popularity worldwide, instigates an urgency for orchid conservation while the pressure on the natural environment upsurges daily (Hágsater & Dumont, 1999).

1) Many orchid species are now considered to be at risk of extinction as a result, directly or indirectly, of human activities that are recognized as the main threat to biodiversity (Hágsater & Dumont, 1999).

2) Signified as the largest family covered by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), international trade is considered a substantial element in this species' decline which shows that it is threatened (Fay, 2009). In this trade, commercial collectors usually select those species that are in high demand for the beauty of their flowers as ornamentals and for horticulture such as for the production of salep in Turkey and other eastern Mediterranean countries (Hágsater & Dumont, 1999).

Though *O. anatolica* is considered threatened, endangered and extinct in many Lebanese neighboring countries such as Syria, Palestine, Jordan and even Turkey (Addam et al., 2017b), it is still common in Lebanon. In this country, many factors contribute to endangering this flower despite the fact that up till now, it grows plentifully compared to other endangered species of Orchidaceae family. Some of these factors are relevant to our 21 years of observation and fieldwork in Lebanon. These factors can be listed as following:

a) The political instability and succession of wars especially the civil war which has lasted for a period of 35 years.
b) The noncompliance of some citizens to the regulations.
c) The lack of the government's expenditure on projects that preserve the environment.
d) The lack of general knowledge among some citizens in protecting the nature.
e) Intensive grazing pressure from the native and introduced mammalian herbivores.
f) The fast urbanization in the regions where these species are discovered as well as the development of land for housing has led to the clearance of large areas of bush lands, forests, and rocky-mountains that host these species.
g) Agriculture and plantation which is due to the new agriculture (especially olive cultivation) as well as to the over collection of the aromatic and medicinal herbs (Addam et al., 2017b).

Many other factors are listed worldwide and can be also applicable to Lebanon such as inappropriate fire regimes like intended wildfires to get charcoal, barbecue fires, home fires or chimney fires or garbage fires which lead to burning hundreds of orchids yearly. In addition to deforestation that results from gathering of firewood by the local people and the selective logging of timber in forests often affect the survival of the epiphytic orchids (Hágsater & Dumont, 1999). The abundance of this species brings about many questions that need to be answered and if they aren't answered, hypotheses should be deducted.

N	E/O	Location	Altitude	N	E/O	Location	Altitude
33°47'13"	35°30'7"	Bshamoun	261	33°56'59"	35°52'47"	Sannine	2628
34° 16' 6.5"	36° 00' 19.2"	Bcharre	1450	33°52'16"	35°44'36"	Bzebdine	828
34°10'58"	35°54'11"	Tannourine	1500	33°52'44"	35°44'45"	Mchikha	824
33°28'13"	35°32'38"	Mlikh	1000	33°54'59"	35°44'53"	Marjaba	1166
33°40'14"	35°40'13"	Maaser Al Shouf	1150	33°39'54"	35°37'0.82"	Jbaa - chouf	1050
33°48'04"	35°41'37"	Sawfar	1320	33°40'45.0"	35°37'14.0"	Aatrine - el-	950
34°17'23"	35°59'00.4"	Ehdin	1550	33°48'20"	35°43'47"	Mdeirej	1275
33°59'37.0"	35°44'14.1"	Faitroun	1250	33°32'4"	35°36'15"	Jezzine	1292
34°03'56"	35°48'11"	Qehmez	1300	33°30'29"	35°34'21"	Tawmat Niha	1260
33°40'13.4"	35°32'16"	Baakleen	817	33°34'2"	35°37'45"	Jabal Niha	1135
33°34'01.6"	35°34'45.6"	Bkasine	800	33°38'8.167"	35°25'42"	Barja - Chouf	229
34°33'11"	36°16'36"	Kbaiyet	700	33°38'22"	35°24'18"	Jyeh - Chouf	15
33°58'40"	35°41'57"	Rayfoun	1000	33°38'16"	35°32'10"	Gharifeh - Chouf	650
34°03'27"	35°45'32"	Jabal mousa	1400	33°06'38.4"	35°24'06.2"	Ain Ebel	800
33°55'08.4"	35°41'01.1"	Bikfaya	1000	33°39'54"	35°30'44"	Jahliyeh	400
33°54'37.6"	35°45'10"	Almrouj	1250	33°40'50.3"	35°32'03.8"	Deir Dourite	650
33°14'29.4"	35°19'35.6"	Joueet	200	33°41'29.6"	35°30'28.9"	Dmit	450
33°39'39.7"	35°37'19.4"	Botmeh	930	33°41'13"	35°31'14"	Kfar Him	520
34°01'03"	35°41'18"	Rihane	510	33°41'29.9"	35°34'50.0"	Beit ed-Dine	900
33°48'39"	35°40'22"	Ras el Harf	800	33°42'55.8"	35°39'24.1"	Brih	800
33°32'43"	35°25'53"	Kfarjarrah	250	33°44'07.2"	35°43'05.6"	Ain Zhalta	1400
33°51'19"	35°40'27"	Btaaline	880	33°44'47"	35°38'59"	Ramliyeh	700
33°51'23"	35°47'17"	Kfarsilwan	1400	33°39'31"	35°36'50"	Moukhtara	800
34°27'30.5"	36°08'35.0"	Qammouaa	1000	33°38'36.6"	35°36'30"	Ammatour	850
33°31'08"	35°33'13.2"	Haitourah	1100	33°35'54.6"	35°36'15.0"	Bater	800
33°51'24"	35°43'27"	Qarnayel	1150	33°37'18"	35°38'45"	Mresti	1200
33°46'12.3"	35°34'06"	Baisour	750	33°45'21.3"	35°45'18.2"	Bmahray	1400
33°40'67.4"	35°30'73"	Banwiti	350	33°46'23.2"	35°42'22.9"	Aazzouniyeh	1100
33°41'093"	35°33'007"	Der Dourit	591	33°46'53.4"	35°43'30.4"	Ain Dara	1300
33°39'8"	35°31'8"	Wadi Bnahleih	800	33°50'49"	35°39'28"	Ras el-Matn	800
33°40'18"	35°31'26"	Jroud Aljahlieh	633	33°51'20"	35°43'36"	Qarnayel	1200
33°47'55.7"	35°35'46"	Aley Ras el jabal	900	33°50'22.6"	35°43'47"	Al Kalaa	1050
33°48'26.7"	35°37'50.3"	Aain el jdaydeh	950	33°52'26"	35°41'44"	Salima	800
33°48'28.4"	35°39'42.6"	Bhamdoun	1050	33°52'09.8"	35°36'29.4"	Beit Mery	700
34°19'02"	35°57'46"	Toula	1150	33°50'42.6"	35°32'46"	Baabda	200
34°19'58"	35°55'55"	Meziara	800	33°48'59"	35°32'10"	Kfarshima	100
34°19'12"	35°56'54"	Mazraat AL Toufah	900	33°48'36.7"	35°31'03"	Choueifat	200
34°17'19"	35°54'44"	Seraal	680	33°45'57.4"	35°32'47.2"	Ainab	750
34°18'37.7"	35°55'12"	Aitou		33°47'31.9"	35°32'18.8"	Ain Aanoub	400
34°08'43"	35°46'54"	Mechmech	1200	33°47'08"	35°40'32"	Majdal Baana	1100
34°07'10.6"	35°45'19"	Annaya	1180	33°48'52.1"	35°38'44"	Baalchmay	980
34°07'45"	35°48'46.8"	Ehmej	1350	33°48'08"	35°41'50"	Saoufar	1250
33°51'58"	35°39'04"	Qsaibe	620	33°44'28"	35°33'44"	Remhala	450
33°52'40"	35°47'50"	Tarchich	1430	33°43'39"	35°38'34"	Majdal El	1000
34°14'12"	35°51'29"	Hardine		33°42'50"	35°37'51"	Wadi El Sitt	600
33°56'39.0"	35°47'11.6"	Baskinta	1250	33°45'31"	35°42'17"	Mechqiti	1100
33°42'30.3"	35°40'24.7"	Barouk	1080	33°45'52.4"	35°41'40.1"	Aghmeed	1100
34°14'03"	35°46'28"	Kfarshlayman	650			Fureidis	
34°12'19"	35°50'30"	Douma		33°33'40"	35°24'39"	Majdelyoun	200
33°45'42"	35°53'00.7"	El Marj		33°33'58.1"	35°24'21.3"	Aabra	150
34°18'27"	35°53'31"	Karm Saddeh	600	33°32'36"	35°28'33"	Kfar Falous	400
33°54'27.4"	35°43'18"	Choueir	1190	33°32'58"	35°27'08"	Lebaa	300
		Frikeh		33°33'52"	35°27'03"	Karkha	300
33°07'30.4"	35°25'47.5"	Bint Jbeil	800	33°32'10.5"	35°27'43.8"	Ain El Mir	350
33°55'11"	35°36'09"	Rabieh	190	33°34'51.1"	35°27'14.1"	Joun	300
33°55'22.6"	35°37'36.1"	Biyada	470	33°36'09"	35°27'27"	Mghairiyeh	370

Table 1. Phytogeographical Illustrated Locations of *O. anatolica* all over Lebanon (Continued …)

N	E/O	Location	Altitude	N	E/O	Location	Altitude
34°01'45	35°50'15"	Chabrouh	1800	33°36'33"	35°28'47"	Mazboud	500
33°55'36.8"	35°43'11"	Chouaya	1010	33°37'50"	35°29'11"	Shheem	600
33°56'48"	35°44'45"	Kfar Aaqab	1150	33°36'43"	35°26'02"	Wardaniyeh	320
33°31'34"	35°27'44"	Ouadi El Leimoun	300	33°36'52"	35°31'14"	Zaarourieh	690
33°31'39"	35°26'52"	Mharbiye	250	33°37'39.6"	35°30'50.1"	Aanout	700
33°22'43"	35°28'59"	Nabatiyyeh	400	33°37'40"	35°32'03"	Hasrout	720
33°54'34"	35°40'16"	Saqiyet el Misk	1050	33°37'35.8"	35°28'05"	Dalhoun	400
33°49'53"	35°33'15"	Yarze	300	33°39'39.8"	35°26'49"	Baasir	200
33°46'51"	35°33'33"	Kaifoun	800	33°37'47"	35°26'49"	Maaniyeh	320
34°12'48"	35°39'24"	Thoum	90	33°37'30"	35°25'29"	Sebline	200
33°26'33.6"	35°36'10"	Al Qotrani	1000	33°36'12.1"	35°33'11.8"	Bsaba	800
33°30'12.4"	35°38'34.1"	Ain El Tine West	1060	33°36'39"	35°32'26"	Mtolleh	750
33°36'53"	35°41'57"	Soghbine		33°35'33"	35°31'44"	Mazraat el Daher	740
		Klaaiat Mrah El Mir	977	33°38'26"	35°35'11"	Mazraat El Chouf	980
33°31'24"	35°35'01"	Jezzine	950	33°39'01"	35°35'27"	Kahlouniyeh	800
33°31'42"	35°30'34"	Rimat	650	33°37'59.3"	35°37'43"	Baadarâne	1050
33°31'14"	35°30'44"	Saidoun	720	33°42'06"	35°37'53"	Kfar Nabrakh	900
33°31'37"	35°31'44"	Haidab	764	33°41'45.6"	35°39'01.8"	Batloun	1050
33°31'5"	53°31'43"	Snayya	888	33°41'48.5"	35°33'38.2"	Deir al-Qamar	810
33°31'18.0"	35°36'08.0"	Ain Majdalayn	1279	33°39'52.5"	35°29'17.0"	Dibbiyeh	470
33°38'58.2"	35°36'39"	Ain Qeni	830	33°39'10.9"	35°29'03.9"	Borjein	500
33°31'46"	35°32'56	Maknouniye	805	33°57'20"	35°41'59"	Daraiya	680
33°59'13"	35°40'54"	Bzemmar	900	33°42'45.7"	35°33'14.9"	Bchetfine	460
34°02'05"	35°41'23"	Kfour	750	33°43'35"	35°31'33"	Kfarmatta	720
34°00'35"	35°46'35"	Keserwan	1250	33°45'11"	35°32'41"	Qabr Chamoun	700
		Fouar - Ayn el Raha	1400	33°44'13.0"	35°31'33.0"	Aabey	800
33.905449	35°43'17.8"	Dhour Chouair	1040	33°44'20.9"	35°29'59"	Baawerta	460
33°55'15"	35°48'24"	Zaarour	1650	33°42'56.2"	35°27'15.5"	Damour	100
33°48'26.9"	35°37'50.9"	Ain el jdaideh	950	33°42'50"	35°28'05"	Mechref	200
33°48'21.2"	35°36'11.6"	Aley	800	33°45'59.0"	35°29'58"	Aramoun	300
33°45'46.6"	35°34'04.2"	Baysour	780	33°46'06.4"	35°29'25.8"	Doha Aramoun	250
33°44'14"	35°38'28"	Kfarniss	950	33°32'18"	35°25'01"	Qraiyeh	150
34°10'54"	35°54'12"	Tannourine el Fawka	1500	33°49'29"	35°44'00.0"	Hammana	1100
34°24'40"	35°57'54"	Kfarhabou	400	33°51'20"	35°47'01"	Kfar Selouan	1700
		Al Aazouniyyeh		33°53'36"	35°48'05"	Majdal Tarchich	1450
		Fraykeh		33°53'35"	35°44'38"	Mtein	1050
34°33'11"	36°16'20"	Qoubaiyet	700	33°54'39"	35°45'10"	Mrouj	1250
34°07'40.6"	36°01'14"	Al Yammouneh	1400	33°53'29.5"	35°40'32"	Baabdat	850
33°59'28"	35°50'35"	Kfardebian	1900	33°52'31.1"	35°40'22.8"	Aarbaniye	600
33°34'14.4"	35°34'34.5"	Dhour Bkasine	820	33°51'31.2"	35°41'28"	Arsoun	800
34°03'58"	35°44'06"	Yahshoush	630	33°50'28.0"	35°42'56.0"	Btekhney	950
34°03'16"	35°45'12"	Nahr el Dahab	1300	33°50'14.3"	35°44'28.1"	Falougha	1250
33°44'56"	35°41'52"	Nabaa el Safa	1000	33°33'14"	35°29'38"	Sfariyeh	500
33°58'56"	35°42'12"	Raifoun	1020	33°06'21"	35°14'07"	Yarine	400
		Der Billaa		33°06'28"	35°16'31"	Marwahin	600
33°32'48"	35°31'21"	Roum	800	33°04'45"	35°22'07"	Rmaich	600
		Bherdo		33°05'50.0"	35°20'07"	Ayta ash Shab	650
33°55'38.7"	35°40'20"	Beit Chabab	680	33°24'12.1"	35°16'23.9"	Aadloun	100
33°47'02"	35°41'39"	Sharoun	1280	33°27'05"	35°17'26"	Sarafand	20
33°59'05.7"	35°48'39.4"	Faqra	1750	33°25'55"	35°22'11"	Tefahta	300
33°59'29.2"	35°42'26.7"	Achkout	1250	33°27'29"	35°22'19"	Merouaniyeh	260
34°00'43.4"	35°49'28.4"	Faraya	1850	33°06'53.5"	35°28'06.7"	Aitaroun	700
33°51'43.5"	35°45'34.3"	Jouar El Houz	1250	33°31'22"	35°23'02"	Maghdouché	200
34°14'49.6"	36°2'14"	Al Arz - Bcharri	1867	33°27'07"	35°26'01"	Zahrani	400
33°26'28.4"	35°33'46.7"	Al Rihan	900	33°30'39"	35°21'53"	Qennarit	70
33°32'56"	35°33'24"	Homsiyeh	950	33°29'32"	35°35'23"	Kfar Houneh	1100
33°27'27.6"	35°34'42.6"	Aaramta	1000				

Table 1. Phytogeographical Illustrated Locations of *O. anatolica* all over Lebanon

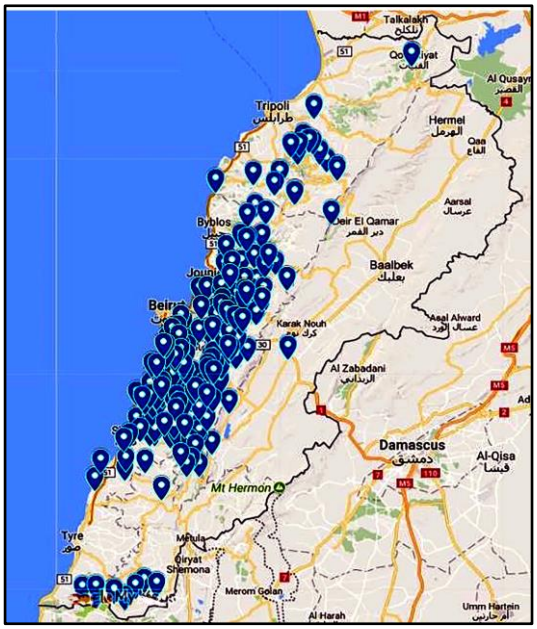


Fig. 6. Distribution of *O. anatolica* in Lebanon

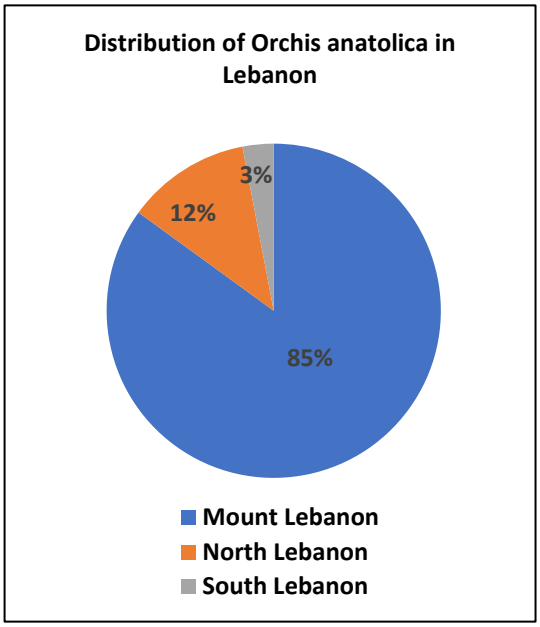


Fig. 7. Distribution of *O. anatolica* in Muhafaza

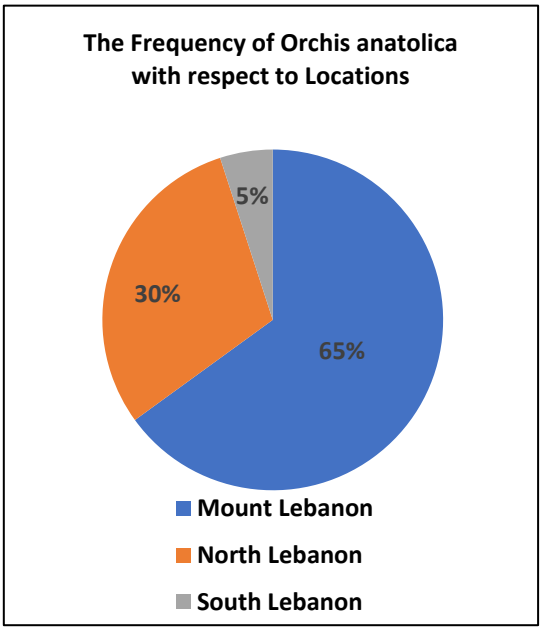


Fig. 8. The Frequency of *Orchis anatolica* Boiss

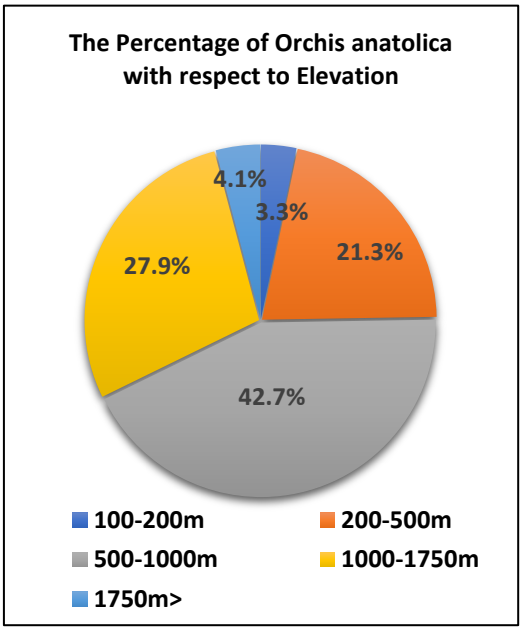


Fig. 9. The Percentage of *Orchis anatolica* with respect to Elevation

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Discussion

In our publication, it is not astonishing to ratiocinate that *O. anatolica* is common in Lebanon, but what is astounding is that this species is not endangered in this country as compared to its neighboring countries. The results show that a very high percentage of *anatolica* are found in Mount Lebanon (85%). Though this high percentage, the presence of this orchid is not constrained in this location whereby it is expected to be found in regions other than Mount Lebanon. The reason why this orchid is abundantly detected in Mount Lebanon (scattered mainly in the forests of its North and South) is explained that this region is its favorable habitat.

The frequency of *O. anatolica* that ranges from 20 to 100 explained as a moderate frequency in addition to that of less than 10 which resembles a low frequency of growth can be explicated as the possibility of this orchid's growth on the Lebanese territories, but our incapability of reaching them due to the political instability, the presence of mines left after the end of war as well as other hindrances. This can be proved that we located its presence within an altitude of 1597m in some mountains, extremely dry regions and in open rocky places with severe environmental circumstances such as snowy, windy, and very rainy ones like in pine forests. We strongly assume that this species is plentifully found in much higher frequencies and we are ready to prove its presence on condition of the availability of a safe atmosphere coupled with a safe access to these regions.

The elevations of 500-1000m as well as 1000-1750m together designate around 70% of *anatolica's* growth which exceeds 200. While others (100-200m, 200-500m, and 1750m>) represent around 30%. It is remarked that there is a relation between the elevation and the time of growth and frequency. An elevation of 100-200m represents a frequency of 3.3% possibly due to a moderate temperature (10-20°C), humidity and deforestation as a result of the fast urbanization. In this elevation, the orchid blossoms abundantly within a period of 1month starting from the end of February till the end of March.

Contrastingly, an elevation of 200-500m represents a frequency of 21.3%, which is due to the fast urbanization and deforestation, and a temperature of 7-15 °C (colder with respect to that of 10-20 °C). In this elevation, it blossoms from 15 March till the end of May. Furthermore, an elevation of 500-1000m perceives a very high frequency of 42.1% due to the existence of many rivers, meadows, rocky-mountains and forests such as Pine Forest, which are preferable habitats in addition to the moderate-cold temperature (8-14 °C), rainfalls and snowfalls. It blossoms in the last 10 days of April till the end of May.

Moreover, an elevation of 1000-1750m represents a frequency of 27.9% whereby it exceeds 200 *anatolicas* reaching 700 rarely, thus cannot be considered as an underestimated quantity. This is due to very low temperatures (5-11 °C), winds, rainfalls, etc. and open spaces rather than forests. It blossoms from 15 May till the beginning of June. In an elevation 1750m> (reaching 2628m), the frequency is considered extremely low 4.1% as a consequence of very harsh environmental circumstances and very low temperature (2-9°C). It blossoms from 15 May till 15 June.

As a conclusion, it is noticed that the frequency of *anatolica* decreases within very low and high temperatures as it favors moderate-cold temperatures ranging between 6 and 14°C. It is also noticed that the blossoming of *O. anatolica* is discerned from February till June (4 months' period) all over the Lebanese territories.

Recommendations

While most orchidologists bemoan the loss of habitat and species, there is not enough action being undertaken on the ground to halt the loss of orchid biodiversity, and any actions helping to reverse the trend must be highlighted and supported politically, technically, and financially. Some of the existing and possible conservation strategies that have global applications should be considered and recommended locally too.

These strategies are:

1) Preparation of global checklists of orchid species and identification of areas of high biodiversity.
2) Legislation and funding to protect, research, and properly manage and monitor such areas.
3) Sharing of plants, seeds, and pollen among orchid growers and botanical gardens (Hágsater & Dumont, 1999).
4) Raising awareness by hosting educational and social events, newsjacking, and distributing brochures…etc. The awareness campaigns should be implemented for people in general and village men/women in particular (Addam et al., 2017b).

Conclusion

The result of this phytogeographical survey revealed that this orchid is common in Lebanon and not endangered as compared to some neighboring countries.

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