



Research Article

FIVE RECORDS ADDED TO THE LEBANESE NATIVE ORCHIDS: *Ophrys omegaifera* subsp. *algarvensis*, *basilissa*, *fleischmannii*, *vasonica* and *Ophrys polycratis* (ORCHIDACEAE)

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Abstract-*Ophrys omegaifera* subsp. *fleischmannii* (Hayek) Del Prete, *Ophrys algarvensis* D. Tyteca, Benito & M. Walravens, *Ophrys omegaifera* subsp. *vasonica* (O. Danesch & E. Danesch) Kreutz, *Ophrys omegaifera* var. *basilissa* (C. Alibertis, A. Alibertis & H. R. Reinhard) Faurh.

Ophrys polycratis P. Delforge spec. nov. are five new subspecies found for the first time in Lebanon at the north and the western slopes of Mount Lebanon (200 to 1100 m altitude). Pine forests, open woodlands and rocky places are their favorite growth places. The new subspecies resemble *Ophrys omegaifera* H. Fleischm. in morphology, but have various differences that are described and illustrated.

Keywords-Bee orchid, *Ophrys omegaifera* subsp. *fleischmannii* (Hayek) Del Prete, *Ophrys algarvensis* D. Tyteca, Benito & M. Walravens, *Ophrys omegaifera* subsp. *vasonica* (O. Danesch & E. Danesch) Kreutz, *Ophrys omegaifera* var. *basilissa* (C. Alibertis, A. Alibertis & H. R. Reinhard) Faurh., *Ophrys polycratis* P. Delforge spec. nov., Orchidaceae, Lebanon, Middle East, taxonomy.

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Introduction

The family Orchidaceae contains about 880 genera and more than 22,000 species (about 25000 species among 850 genera with respect to others that are divided into two main groups: Epiphytic and Terrestrial orchids. The distributed orchids in the Mediterranean and Europe are mainly terrestrial. [1,2]

Among orchids, the genus *Ophrys* is known as bee orchid because the flower resembles the fairy body of bees. Scientifically *Ophrys* means "eyebrow" in Greek language.

In the book Natural History by Pliny the Elder (23-79 AD) the name "*Ophrys*" was mentioned for the first time. In 1753 Linneus categorized it as a special group consisting of a large number of distinct Orchids recognized by their flowers that resemble the body of hymenoptera and other insects which they depend on for their pollination. [3,4]

In addition, the genus "*Ophrys*" contains two sections: *Euophrys* and *Pseudophrys* and distributed in North Africa, Asia Minor, Caucasus Mountains, From Central to South Europe with it's the largest concentration of species in the Mediterranean region. [3,5]

The debate among botanists worldwide who have had antagonistic opinions and views related to the classification of orchids is not solved yet. On the contrary, the problem is becoming even more complicated especially in Europe (between the scholars of different European countries). On the other hand, another big conflict exists between Europe and Kew. The genus *Ophrys* is the most controversial in the Orchidaceae family. [3,7,8,9,10,11,12]

Classifications are based and build on different methodologies; Observation (comparisons of structural differences and similarities), Comparative Assessments of Mutual Relationships (Cladistic analyses) and Reproductive Isolation/Interaction (pollinator specificity as an isolation mechanism). [13]

All these kinds of scholars' classifications one way or another are criticized for

their unclearness in taxonomy and said to have positive and negative results that can't be completely based on.

The group of *Ophrys omegaifera* is a very complicated group for identifying its subspecies. During field work, and at the first glance, researchers find difficulty in differentiating these subspecies due to their remarkable similarities.

Ophrys omegaifera was described for the first time by Fleischmann from Lassithi (Crete) in 1925. Its name alludes to the prominent omega like (**ω**) shape at the speculum's tip.

Ophrys omegaifera is a member of a fast growing group which has been studied closely by several scientists and botanists in Europe like Messrs, Delforge, Paulus and in Lebanon, Addam and Bou-Hamdan. The European scientists concentrated on the orchids of the Aegean islands and few places in the Mediterranean but not in most countries of the Middle East. [14]

Lebanon, Syria and Jordan have been excluded from these studies by most scientists for a long time, even though these countries have the richest supplies of these species. A group of thirteen species and subspecies make up *Ophrys omegaifera* group. Two of them inhabit the western end of the Mediterranean basin (*Ophrys dyris* and *Ophrys vasconica*) but not anymore because they were discovered in Lebanon. All the other ones are oriental: the Aegean Islands, Crete, Anatolia, Cyprus and the Middle East to Syria, Lebanon and Palestine. By the complete lack of the V-shaped groove at the base of the labellum, *Ophrys omegaifera*, *Ophrys omegaifera* subsp. *dyris*, *dyris* var. *maculate*, *fleischmannii*, *basilissa*, *gharifensis*, *hayekii*, *algarvensis* and *israelitica* are the representative species, expliciting perfectly the characteristic feature of the group. *Ophrys vasconica*, and *O. sitiaca* are species of hybrid origin between a species of this group (respectively *O. dyris* and probably *O. omegaifera*) and another one of the *O. fusca* group. Researchers of this study believe they ought to be put in a group of their own

The Aegean *omegaifera* have now been split into a further three species differentiated primarily by geography and flowering times: *Ophrys apollonae*, *polycratis* and *meropes*. But even though, *Ophrys polycratis* is more accepted to be a member of the *omegaifera* group due to its similarity to their morphology, (with respect to KEW's classification, it is a synonym of *Ophrys fusca*). [3,8,15,16,17,20,21,22,25,26,36]

Worldwide fifteen species and subspecies are reported to form this family;

Ophrys omegaifera H. Fleischmann 1925, Pollinator: *Anthophora dalmatica*.
Ophrys omegaifera subsp. *algarvensis* (D. Tyteca, Benito & M. Walravens) Kreutz 2004, Pollinator: *Colletes albomaculatus*.
Ophrys omegaifera subsp. *apollonae* Paulus & M. Hirth 2009, Pollinator: *Anthophora nigriceps*.
Ophrys omegaifera var. *basilissa* (C. Alibertis, A. Alibertis & H.R. Reinhard) Faurh 1990, Pollinator: *Anthophora subterranean*.
Ophrys omegaifera subsp. *dyris* (Maire) Del Prete 1984, Pollinator: *Anthophora atroalba*, *Anthophora balearica*.
Ophrys omegaifera subsp. *dyris* var. *maculata* F.M. Vázquez 2008, Pollinator: ??
Ophrys omegaifera subsp. *fleischmannii* (Hayek) Del. Prete Hayek 1926, Pollinator: *Anthophora sicheli*.
Ophrys omegaifera subsp. *gharifensis* subsp. *novo* K. Addam & M. Bou-Hamdan 2013, Pollinator: ??
Ophrys omegaifera israelitica H. Baumann & Künkele 1988, Pollinator: *Anthophora flavipes*.
Ophrys omegaifera subsp. *hayekii* (H. Fleischm. & Soó) Kreutz. 2004, Pollinator: ??

Ophrys omegaifera subsp. *sitiaca* H. F. Paulus, C. Alibertis & A. Alibertis. 1988. Pollinator: *Anthophora nigroaenaea*.

Ophrys omegaifera subsp. *vasconica* (O. Danesch & E. Danesch) Kreutz 1969 Pollinator: *Andrena sp. dalmatica*.

Ophrys polycratis P. Delforge spec. nov. 2008. Syn: *Ophrys omegaifera* ssp. *polycratis* (Delforge) comb. ined. Pollinator: *Anthophora*. [3,8,15-17,20-22,25, 26, 37,38]

The Lebanese flora hosts more than 3150 species, subspecies and varieties of plants documented by various botanists. Lebanon is a small country (10,452 km²) in comparison to other big Mediterranean countries like Italy, France, Palestine, Greece, Turkey, Syria, and others, even though it is an important reserve for many endemic, native and very rare species of orchids. The geological up-bringing, topographical diversity and affirmative climate boosts greatly the richness of orchids' species. [1,5]

The native flora of Lebanon contains ninety-five species and subspecies of the *Orchidaceae* family in Lebanon. Thirty-nine of them were identified to belong to the *Ophrys* genus. However, new five subspecies of this family (*Omegaifera* group) have been discovered and described here. These new subspecies have been recognized, studied and documented for the first time in Lebanon from the years 2012-2016.

Both Prof. George Edward Post (1838-1909), the author of "Flora of Syria, Palestine and Sinai," and Dr. Paul Mouterde (1892-1972), the author of "Nouvelle flore du Liban et de la Syrie," mentioned the presence of *Ophrys fusca* with the description of *ophrys omegaifera*. The reason for that was because at that time the group *Omegaifera* was not identified and accepted as a separate group and so they mixed between the two different species. They did not distinguish between the morphologic structure of both species *Fusca* and *Omegaifera* and they called them al *Ophrys fusca*. The new classification of the *Omegaifera* contains *fifteen species and subspecies worldwide*. [1,5,25-31,37,38]

In 2009 Ricardus, M & Myrna Haber, authors of *Orchids of Lebanon* mentioned (for the first time) the presence of *Ophrys omegaifera* and four subsp. (*Ophrys* *omeg*. Subsp. *miirabilis*, *sitiaca israelitica* & *dyris*) in Lebanon. A very wide search was done for three years and no publications were found for these species in any scientific journal neither specimens in herbariums nor any mentioned locations for them (till now). [31]

Dr. Khodr Addam and Mounir Bou-Hamdan started the search for the *Omegaifera*

group about sixteen years ago. It was not easy to identify the subspecies in this group due to the variable classifications and the big number of different names for every single subspecies. At last and since there is no single classification between all scholars, we decided to identify this group following the Kew, P. Delforge and H. F. Paulus by choosing the most clear description from their classifications that satisfy us, but this does not mean that we agree completely with their classifications. The aim of this is to make the differentiation between the members of this group easy, simple and clear for us and others during the field work. That's why we mentioned all the names of the *Ophrys omegaifera*'s subspecies we had found in our literature review. Even though some of these are not accepted by the KEW, we think that some of them deserve to be accepted and more investigations need to be done before giving a final decision about them. [7,26,37]

Common morphology of all Omegaifera's flower.

Description of *Ophrys omegaifera* H. Fleischmann (1925)

Imposing orchid with large flower. The lip of *Ophrys omegaifera* is deeply 3-lobed in the center, external border of lateral lobe making a mean angle of 40°-65° with longitudinal axis; the base of the lip is not (flat throat, lack of longitudinal groove at the lip base), or only slightly grooved (the evolution from a grooved throat to a flat throat could have occurred twice in *Pseudophrys*.); lip ± kinked at base, central third flat, tip very convex; speculum is often contrasting with a pale white, thick, omega like (w) shape at the lower edge of the macula. The flower resembles a small boxing glove, but each flower of the subspecies might vary substantially. [12,13]

New established subspecies

***Ophrys omegaifera* subsp. *algarvensis* (D. TYTECA et al.) K. REurz. (2003)**

Morphologic description

Ophrys omegaifera subsp. *algarvensis* resembles *Ophrys dyris* but have 2-5 flowers, a little bit bigger in size; lateral sepals 14-16mm long; petals 9-12mm long; the lip is less convex, 15- 19mm x 12-15mm, more horizontal, brown to dark slate-grey with short hairs and rarely with silver reflections; the margin broader is hairless, the external border of lateral lobe makes an angle of 28-42° with longitudinal axis; lateral lobes are smaller, 2.5-4.2mm x 1.5-4mm; the median lobe is more elongated and emarginated, 6- 8.5mm x 8-11mm; the speculum is usually brown or reddish, with a broad omega like (w) shape at tip, sometimes white washed reddish; the base of stigmatic cavity is less hairy even sometimes hairless with ± grooved.

NB The lip is moderate convex (especially at the base) and the lateral lobes, at the top of the lip the pilosity never reaches the extremity that have a glabrous margin. [12]

Location

Botmeh (N 33° 39' 445" EO 35° 38' 251"), 1054 m alt, 50 km away from the capital Beirut. Located in Chouf District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-1,3]

Deir El Harf (N 33 50 526 EO 35 41 515), 1080 m alt, 31.1 km away from Beirut. Located in the Baabda District one of the eight mohafazats (governorates) of Lebanon. [Map-2,3]

Gharifeh (N 33° 30' 55" EO 35° 29' 281"), 761 m alt, 56 km away from Beirut. Located in Chouf District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-2,3].

Aaynab (Ras Eljabal), (N 33° 46' 126" EO 35° 33' 3385"), 730 m alt., 28 km away from Beirut. Located in Alay District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-1,3].

Kfar Hazir (N 34 18' 34" EO 35 45' 54") alt. 307m 70km away from Beirut. Located in Koura District (Qada'a), an administrative division of North Lebanon Governorate (Mohafazah). [Map-2,3].

Habitat characteristics

It grows in fresh dry calcareous basic-rich soils and in moist soils (even water logged), under pine trees (its preferable place of growth), poor meadows, open

rocky place, woodlands, and direct sunlight.



Fig-1 *Ophrys omegaifera* subsp. *algarvensis* (D. TYTECA et al.) K. REurz. in flower and from above. (Photo: Addam K.)

Phenology

From January to the middle of March.

Date of discovery

Found for the first time at 2012 by Dr. Khodr Addam and Mounir Bou-Hamdan.

Holotype

A voucher specimen of the holotype (2000 5 II 2012ka) was deposited in the Herbarium of Global University (Lebanon). Collected by Dr. Khodr Addam at 5/II/2012 collection number (2000 5 II 2012ka).

Ophrys omegaifera* var. *basilissa (C. Alibertis, A. Alibertis & H. R. Reinhard) Faurh. (1990)

Morphologic description

Ophrys omegaifera var. *basilissa* looks the same as *Ophrys omegaifera* but its size is bigger, robust plant 10-30 cm height; rather dense inflorescence, with 2-5 large flowers 28-35 mm; the lateral sepals are ovate and pointed; petals are ochre or olive-green to dark brown with darker margin, elongated and glabrous, the lip is pointing horizontal or upwards, trilobed, very convex, constricted at its base, with recurved sides, the color is dark slate-grey to brownish-purple with short, thick reddish-brown hairs, it is more red and broader than that of *O. omegaifera* subsp. *omegaifera*, the lateral lobes (4-6mm x 4-8mm) have triangular-rounded form; median lobe (6.5-10.5mm x 13-19mm); the speculum is less shiny, often blue or purplish-blue and sometimes brown, and rarely marbled whitish, an omega like (ω) shape always exist at the tip that have white, grey or pale blue color; stigmatic cavity 4.5-6mm high, 4-5.5mm wide, the column is obtuse. [32,33,34]

Location

Botmeh (N 33°, 37', 531" EO 35°, 33', 514") 851 m alt. (N 33°, 37', 525" EO 35°, 33', 539") alt. 863m alt. Located in Chouf District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-1,3].

Aljourah (Gharifeh) (N 33° 30' 55" EO 35° 29' 281"), 761 m alt., (N 33° 37' 526" EO 35° 33' 546"), 867 m alt., 56 km away from Beirut. Located in Chouf District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-2,3].

Habitat characteristics

Dry fresh calcareous basic-rich soils, open pinewoods (under pine trees is its preferable place of growth) but it can grow in direct sunlight, poor meadows, open rocky place and other woodlands.

Phenology

Early from January to February (sometimes 2 weeks later (depending on the altitude and the low temperature) but always about one month before the blooming of *Ophrys omegaifera*).

Date of discovery

Found for the first time at 2012 by Dr. Khodr Addam.



Fig-2 *Ophrys omegaifera* var. *basilissa* (C. Alibertis, A. Alibertis & H. R. Reinhard) Faurh. in flower and from above. (Photo: Addam K.)

Holotype A voucher specimen of the holotype (2001 25 II 2012ka) was deposited in the Herbarium of Global University (Lebanon). Collected by Dr. Khodr Addam at 25/II/2012 collection number (2001 25 II 2012ka).

Ophrys omegaifera subsp. *fleischmannii* (Hayek) Del Prete. (1926)

Morphologic description

Ophrys omegaifera subsp. *fleischmannii* resembles *Ophrys omegaifera* subsp. *omegaifera* but smaller, shorter and robust, 7-15 cm height; smaller flowers; lateral sepals 11-15mm x 6-9 mm; petals are purple, brown to green, sometimes edged purple, elongated, glabrous with rounded tips, 8-11mm x 2-3.5mm; the lip is 13-17mm x 10-16mm), irregular, with silver reflections; *side lobes and mid-lobe are long-hairy*, speculum is usually shiny, brown, dark blue with brownish reflections, rarely marbled whitish, with a broad, distinct, glossy, hairless omega like (ω) shape at the tip, white, greyish or bluish; stigmatic cavity 3-4mm high, 3.5-4.5mm wide. [12,14]



Fig-3 *Ophrys omegaifera* subsp. *fleischmannii* (Hayek) Del Prete. in flower and from above. (Photos: Addam K.)

Location

Aaynab (Ras Eljabal), (N 33° 46' 126" EO 35° 33' 338"), 730 m alt., 28 km away from Beirut. Located in Alay District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-1,3]

Botmeh (N 33°, 37', 525" EO 35°, 33', 539") alt. 863m alt. Located in Chouf District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-1,3]

Habitat characteristics

It grows in calcareous basic-rich fresh dry soils, always under or near pine trees (its preferable place of growth) but in total shade, poor meadows, open rocky place, woodlands, and direct sunlight.

Phenology

From February till the middle of March.

Date of discovery

Found for the first time at 2012 by Dr. Khodr Addam and Mounir Bou-Hamdan.

Holotype

A voucher specimen of the holotype (2002 15 I 2012ka) was deposited in the Herbarium of Global University (Lebanon). Collected by Dr. Khodr Addam at 15/II/2012 collection number (2002 15 I 2012ka).

***Ophrys polycratis* P. Delforge spec. nov. (2008) Syn *Ophrys omegaifera* ssp. *polycratis* (Delforge) comb. ined. [38]**

Morphologic description

Looks like *Ophrys basilissa*, but much smaller and shorter, around 20 cm height; usually with two (sometimes up to four) medium sized smaller flowers, 18,5 cm with a very increased pilosity of the lip. The most interesting characteristic of this subspecies is its rather later flowering time (one month later than *Ophrys omegaifera* depending on the altitude). The flower grows in Lebanon only at high altitudes (800m - 1100m) and never seen under that. [21,34,35]



Fig-4 *Ophrys polycratis* P. Delforge spec. nov. from above. (Photos: Addam K.)

Location:

Ain Al Jdaideh (N 33° 48' 27" EO 35° 38' 5"), 978 m alt. 19 km away from Beirut. located in Aaley District(Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-1,3].

Ras El Harf (N 33° 50' 51" EO 35° 41' 51"), 1053 m alt., 25 km away from Beirut. Located in Baabda District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah). [Map-2,3].

Habitat characteristics

Fresh dry calcareous basic-rich soils and under pine trees are its preferable place of growth, poor meadows, open rocky place, woodlands, and direct sunlight.

Phenology

From the end of March to the beginning of May.

Date of discovery

Found for the first time at 2013 by Dr. Khodr Addam.

Holotype

A voucher specimen of the holotype (2004 24 III 2013ka) was deposited in the Herbarium of Global University (Lebanon). Collected by Dr. Khodr Addam at 24/III/2013 collection number (2004 24 III 2013ka).

***Ophrys omegaifera* subsp. *vasonica* (O. Danesch & E. Danesch) Kreutz. (1969)**

Morphologic description

Description 12-28 height; 2-10 flowers; sepals are 10-13mm x 6-8mm; petals are hairless, spreading, brownish to yellowish-green, 6-9mm x 1.5-3mm and oblong, margins; the lip is 12-20mm x 13-18mm , 3-lobed, slightly convex, hairs are dense, short, often with silver reflections with fine hairless yellow border, the tip of lobes is pale brown or slate-grey; lateral lobes divergent, triangular, rounded and slightly convex; median lobe is rather spreading, broadening and emarginated; the speculum is shiny, purplish to , pale brown and sometimes slate- grey, often strongly marbled whitish, sometimes is densely hairy, with a blue-grey, shiny, hairless omega like (ω) shape at tip, often blurred edges; yellowish or greenish stigmatic cavity, with, short, dense, whitish hairs, ± 'V' groove.[12]



Fig-5 *Ophrys omegaifera* subsp. *vasonica* (O. Danesch & E. Danesch) Kreutz from above and specific macro. (Photos: Addam K.)

Location

Botmeh, (N 33°, 37', 525" EO 35°, 33', 578") 1054 m alt, 50 km away from the capital Beirut. Located in Chouf District (Qada'a), an administrative division of Mount Lebanon Governorate (Mohafazah).

Gharifeh, (N 33 46' 124" EO 35 33' 338"), 720 m alt., 56 km away from Beirut. Located in Chouf District (Qada'a), an administrative division of Mount Lebanon

Governorate (Mohafazah).

Habitat characteristics

Full sun to mid-shade, on dry to moist, alkaline substrates, grassland, open pine and oak woodland.

Phenology

From the beginning of February to the middle of March.

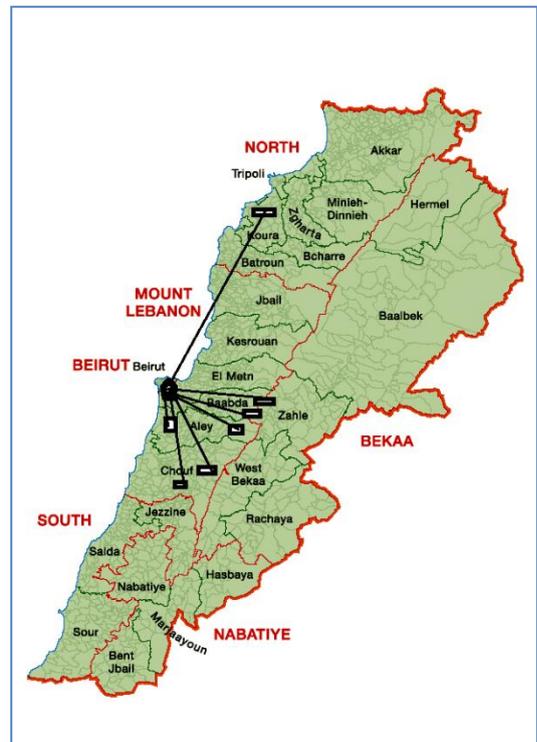
Date of discovery

Found for the first time at 2013 by Dr. Khodr Addam and Mounir Bou-Hamdan.

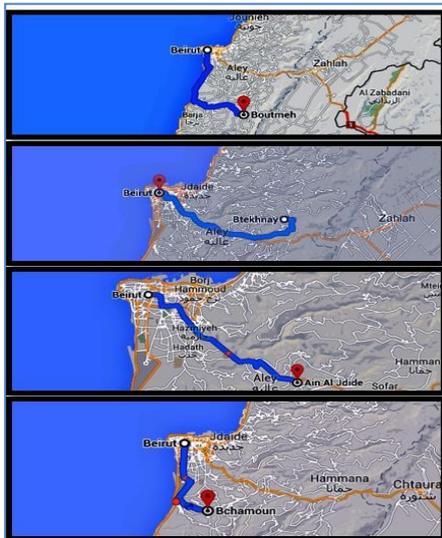
Holotype

A voucher specimen of the holotype (2005 9 II 2013ka) was deposited in the Herbarium of Global University (Lebanon). Collected by Dr. Khodr Addam at 9/II/2013 collection number (2005 9 II 2013ka).

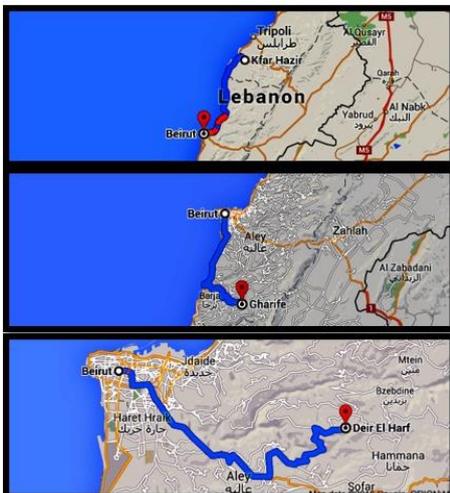
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Map-3 Distribution of new discovered *Ophrys omegaifera subsp.* in Lebanon



Map-1 Distribution of new discovered *Ophrys omegaifera subsp.* in Lebanon



Map-2 Distribution of new discovered *Ophrys omegaifera subsp.* in Lebanon

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