

Identification, characterization and germination parameters of three species of the genus *Crocus* from the Iridaceae family in the Damascus countryside – Syria

تحديد وتوصيف ومعايير إنبات ثلاثة أنواع من جنس *Crocus* من فصيلة Iridaceae في ريف دمشق – سورية

Reem Rustom is a Ph.D

student in the Department of Horticultural Sciences

Faculty of Agriculture, Damascus University

reem.rustom@damascusuniversity.edu.sy

<https://doi.org/10.5281/zenodo.10049187> VOL2023 ISSUE-OCTOBER

Published 28OCT2023

Abstract:

Field tours in 8 areas (Al-Marah - Qara - Al-Sarukhiya - Rankus - Jabadin - Wadi Askar (Al-Rawda) - Sa'sa - Ain Hour) in the Damascus Countryside Governorate during the months of October and November 2019 and 2020, and the taxonomic study of the genus *Crocus* in the Damascus Countryside Governorate confirmed the presence of three species: *Crocus cancellatus*, *Crocus aleppicus* *Crocus damascenus*

The results showed that reticulated saffron is a perennial herbaceous plant. The average leaf length is 8 cm, and the average number of the leaves are 4 leaves, the average length of the stigma is 1.2 cm. The fruit is an oval pod with an average length of 1.8 cm and is purple in color with purple stripes. The average number of seeds is 13.3 seeds and the average weight of 100 seeds is 0.813 g. The seed color is reddish brown.

Crocus damascenus is a perennial herbaceous plant with an average leaf length of 8 cm, and an average number of leaves of 4 leaves, with an average color of stigma length of 3.7 cm. The fruit is an elongated, paper-shaped box with an average length of 2.8 cm. It opens podium from the top through three leaves of a light green color with dark brown, an average number of seeds. 16 seeds, average seed weight 0.8910 g, seed color reddish brown.

Crocus aleppicus is a perennial herbaceous plant with an average stigma length of 2 cm. The fruit is not present. Aleppo saffron is characterized by a short life cycle of 2-3 weeks and does not produce seeds.

It was found that the gravimetric seed mass of both reticulated and damask types increased by 52% after soaking for 24 hours in wet filter paper,

Keywords: wild saffron, *Crocus cancellatus*, *Crocuse aleppicus*, *Crocus damascenus*, Syrian flora.

الملخص:

جولات ميدانية في 8 مناطق (المراح - قارة - الصاروخية - رنكوس - جبعدين - وادي عسكر (الروضة) - سعسع - عين حور) في محافظة ريف دمشق خلال شهري تشرين الأول وتشرين الثاني 2019 و2020 وأثبتت الدراسة التصنيفية للجنس *Crocus* في محافظة ريف دمشق وجود ثلاثة أنواع هي: *Crocus Cancellatus*، *Crocus aleppicus* و *Crocus damascenus*

أظهرت النتائج أن الزعفران الشبكي نبات عشبي معمر، متوسط طول الورقة 8 سم، ومتوسط عدد الأوراق 4 وريقات، ومتوسط طول الميسم 1.2 سم، والثمرة عبارة عن قرنة بيضاوية متوسط طولها 1.8 سم ولونها أرجواني مع خطوط أرجوانية، متوسط عدد البذور 13.3 بذرة، ومتوسط وزن 100 بذرة 0.813 جرام، ولون البذور بني محمر.

والزعفران الدمشقي نبات عشبي معمر، متوسط طول ورقته 8 سم، ومتوسط عدد أوراقه 4 أوراق، ومتوسط لون وصمة العار طولها 3.7 سم، والثمرة عبارة عن صندوق مستطيل على شكل ورق متوسط طولها 2.8 سم، ويفتح المنصة من الأعلى عبر ثلاث أوراق ذات لون أخضر فاتح مع بني غامق، متوسط عدد البذور 16 بذرة، متوسط وزن البذرة 0.8910 جرام، لون البذرة بني محمر.

Crocus aleppicus هو نبات عشبي معمر يبلغ متوسط طول المياسم فيه 2 سم، والفاكهة غير موجودة، ويتميز الزعفران الحلبي بدورة حياة قصيرة تتراوح من 2-3 أسابيع ولا ينتج بذور.

ووجد أن كتلة البذور الوزنية للنوعين الشبكي والدمشقي زادت بنسبة 52% بعد نقعها لمدة 24 ساعة في ورق الترشيح الرطب.

الكلمات المفتاحية: الزعفران البري، *Crocus Cancellatus*، *Crocuse aleppicus*، الزعفران الدمشقي، الفلورة السورية.

Introduction:

Many scientific efforts have been made to study the Syrian flora from ancient times until now, with the aim of introducing the important biological treasure, which includes many plant species widespread in the Syrian nature. However, these scientific studies and research remained short of ambition, and there must be concerted efforts between all relevant research institutions and Arab and international organizations. To search for more of this natural heritage, preserve it, and ensure its continuity in order to achieve sustainable development for the local population by securing food, fodder, fuel, and medicine. (Atlas of Biodiversity in Syria, 2002) (Atlas of Syrian Desert Plants, 2008).

The genus *Crocus* belongs to the kingdom Plantae, phylum Magnoliophyta, class Liliopsida, order Asparagales, family Iridaceae (Al-Wara, 1982).

The moderate climate in Syria provides a good environment for the growth of a wide range of plants, many of which are used in manufacturing industries (perfumes, soap) and pharmaceutical industries due to their important and multiple medical benefits. It has been shown that there are 3459 plant species falling under 865 plant genera within 131 plant families. Medicinal and aromatic content is high in the Syrian plant flora (Handa et al., 2006).

The current situation of biodiversity in Syria is extremely critical, and is manifested by the deterioration or extinction of some ecosystems, or the shrinkage or disappearance of some wild plants. The reason for this is the deterioration of natural environments, as a result of undirected exploitation of natural resources, overgrazing in forests, and frequent fires. Cultivation of the desert and draining of swamps.

The disappearance of plant species means the loss of their stock of genetic traits that developed over thousands of years, which means the loss of great opportunities to find many solutions to food, medicinal, and perhaps industrial problems, by using them directly or by introducing them into genetic improvement programs.

It should be noted that the loss is not only through the disappearance of plant species; Indeed, some of them deteriorate genetically through the disappearance of many of their ecotypes and varieties due to the shrinkage of their natural distribution area and the deterioration of their natural environments, which negatively affects their adaptation to environmental changes or when they are introduced into breeding programs to develop varieties with specific characteristics (Nahal, 1989).

Saffron was grown in the tenth century AD in Iran, where it was and is still grown in the Kashmir region. With the Mongols' attack on Iran, saffron found its way to China, and in the tenth century AD the Arabs carried it to Andalusia. (Atlas of Medicinal Plants in the Arab World, 2012)

The Iridaceae family includes about 70 plant genera and about 1,500 plant species. They are perennial herbaceous plants with rhizomatous tuberous bulbs or tuberous bulbs, and rarely small shrubs. They are spread all over the world. The leaves are sometimes dense and double-rowed. The flowers are single, as in saffron, or arranged in inflorescences, as In the Iris genus, it is usually radial in shape, and sometimes bisexual. The ovary is bisexual, the ovary is inferior, and the male is three-stammered. The fruit is a multi-seeded cassette, one of the most important of its genera:

The Iris genus: It includes about 300 plant species, most of which are grown for ornamental and aromatic purposes.

The Crocus genus: It includes 50 plant species, the most important of which is cultivated saffron, which is an herbaceous plant that includes a tuberous, earthen bulb. During flowering, the ovary remains under the surface of the soil. The fruit is a pod that emerges from the soil during seed maturation. (Al-Sabbagh et al., 2012)

The Crocus genus has about 100 plant species (Harpke et al. 2013). Information on saffron seed germination is limited (Baskin, 2014) and the majority of the genus Crocus appears to have similar germination characteristics such as post-ripening conditions and photosensitivity such as cyclamen and clover.

Saffron seed germination does not require special conditions, and it can easily germinate in field conditions when it is planted on time in the 10th month, taking into account the negative impact of the surrounding environment and environmental conditions. (Evangelia and Costas.2015).

The duration of the elimination of physiological dormancy varies depending on the species and is usually from two months to a year. Among the factors affecting the rate of physiological dormancy (temperature, humidity, seed oil content, and outer seed coat) (Iglesias-Ferna'ndez et al, 2011)

There is a role for breaking dormancy in seeds through alternating temperatures in summer and winter (Baskin and Baskin, 2004).

Physiological dormancy can be broken by storing dry food at a high temperature, which requires a period of 3 months, and this happens naturally during the summer (Ziyan FuA et al 2013).

The Crocus genus has about 100 plant species (Harpke et al. 2013). Information on saffron seed germination is limited (Baskin, 2014) and the majority of the genus Crocus appears to have similar germination characteristics such as post-ripening conditions and photosensitivity such as cyclamen and clover.

Saffron seed germination does not require special conditions, and it can easily germinate in field conditions when it is planted on time in the 10th month, taking into account the negative impact of the surrounding environment and environmental conditions. (Evangelia and Costas.2015).

The duration of the elimination of physiological dormancy varies depending on the species and is usually from two months to a year. Among the factors affecting the rate of physiological dormancy (temperature, humidity, seed oil content, and outer seed coat) (Iglesias-Ferna'ndez et al, 2011)There is a role for breaking dormancy in seeds through alternating temperatures in summer and winter (Baskin and Baskin, 2004).

Physiological dormancy can be broken by storing dry food at a high temperature, which requires a period of 3 months, and this happens naturally during the summer (Ziyan FuA et al 2013).

Saffron seeds have a long growth capacity, and many seeds do not germinate until after a year or more and remain dormant in the ground. (Evangelia and Costas, 2015)

The external shape of the seeds of the saffron genus did not differ significantly between the varieties, while the seed sizes were significantly variable (Mehmet et al, 2018)

Due to the lack of taxonomic studies that dealt with plant species widespread in the Syrian flora, the importance of this study lies in the morphological documentation of some species of the genus Crocus from the Iridaceae family spread in the Damascus countryside area, with the aim of identifying them, establishing a taxonomic key for them, and confirming their presence in the Syrian flora.

Wild saffron is one of the most important wild and medicinal species widespread in Syria. Due to the lack of research on this species, in addition to the severe shortage and deterioration of the corms of this wild species, it makes it an endangered species in addition to its very low. -

Research materials and methods reproduction rates:

1-3 -Research materials:

Field trips were conducted in the areas of the Damascus countryside governorate to collect and study wild species of saffron of the genus *Crocus* during the months of October and November of the 2019 and 2020 study seasons, where the following species were collected:

- a. *crocus cancellatus*
- b. *crocus damascenus*
- c. *crocus aleppicus*

-2-3 -Methods:

1-2-3 -Collecting samples: The plants were collected in the flowering stage, where the whole plant (flowers and corms) was collected and replanted in pots with the aim of monitoring the plant and following its growth and phenological stages. The place of collection and the date of collection were written on the pot.

Study of the morphological description of plants: The plants were classified and described by referring to the relevant scientific references:

- Motuerde, 1966.
- Atlas of Biodiversity, 2002.
- Atlas of the Syrian Desert 2008.
- Atlas of medicinal and aromatic plants in the Arab world 2012.
- Descriptors for *crocus* (*crocus* spp), 2015.

-2-2-3 Floral indicators: flower neck length, flower petal shape, petal head shape, flower tube color, dominant color in the petal, color of lines and veins on the petals, venation pattern, flowering date, stigma branching pattern, average stigma length, Stigma color.



Figure No. (1) The shape of the petals. Figure No. (2) The apex of the petals

Descriptors for *crocus* (*crocus* spp), 2015

-Leaf indicators: presence of leaves at flowers, average leaf length, average number of leaves, leaf color, and presence of a white stripe in the center of the leaf.

-Fruit indicators: average number of fruits, average fruit length, average number of seeds per fruit, average seed weight (weight of 100 seeds), fruit shape, seed color, fruit color.



Figure No. (3) The shape of the fruit. Figure No. (4) The shape of the seed

Descriptors for crocus (*crocus* spp), 2015

Indicators of corms: the outer covering of the corm, the average length of the corm, the average diameter of the corm, and the shape of the corm.

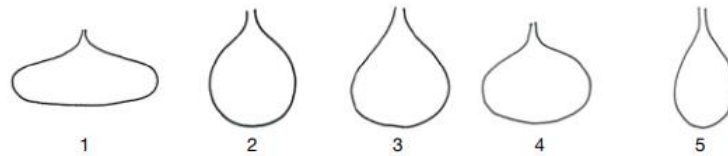


Figure No. (5) The shape of the corms

Descriptors for crocus (*crocus* spp), 2015

Research materials and methods Seed treatments:

Seeds of wild saffron species (*Crocus cancellatus* *Crocus damascenus* (obtained from the process of inventorying wild saffron plants during the two years 2019-2020, as they were collected in the period between the end of July and the beginning of August from the Damascus countryside governorate from the following locations) reticulated saffron (Qara, Ain Hour, Jabadin, Al-Sarukhan, Sasa'a and Damascene saffron (Al-Marah-Rankous).

Plant material:

Calculating the weight mass of the seeds: The seeds are weighed after placing them in a petri dish with two filter papers, with the papers moistened, and kept for 24 hours in laboratory conditions (24 degrees Celsius and humidity 20-30%), Then the seeds are removed, dried with tissues, re-weighed, and the percentage increase in weight mass in the seeds is calculated. From the following equation:

$WS = (WI-WF/WF) * 100\%$ Where: WI = seed weight after 24 hours of seed soaking

WF = fresh seed weight

WS = percentage of weight gain of seeds Ziyen FuA et al 2013(

Weight of a thousand seeds: The importance of this indicator comes from the fact that it enables us to identify the quality and vitality of the seeds and their quality, as it indicates the size of the seed and its fullness of nutrients. When the seeds are equal in size, evidence of a greater saving of nutrients is the weight of a thousand seeds, and it can be calculated mathematically when the quantity of available seeds is few according to the following equation:

$$\text{Weight of 1000 seeds} = \text{average weight of 100 seeds} \times 10 \text{ (ISTA, 1996)}$$

Seed treatments to break the dormancy phase:

Many results of studies related to the effect of seed treatment before planting in physical and chemical ways were used to reduce the time required for germination and increase its percentage (%). Planting seeds with a layer of soil and herbs from the same site as collecting wild plants was used, cold mulching was used, and gibberellic acid was used in Stimulating seeds to germinate. In general, 4 treatments were used with the aim of influencing the seeds internally and externally to improve their germination:

- 1 -T1 The seeds were placed in water for 24 hours, then planted in tubs containing soil + grasses (surface layer) from the original location of the collection site.
- 2 -Cold fertilization by placing the seeds in moist sand at a temperature of (4°C) for a period of 154 days, then storing them at a temperature of 10°C with sufficient humidity.
- 3 -Soaking with gibberellic acid, concentration of 400 mg/L, for 20 minutes and placing it between two leaves of a Petri dish.
- 4 -The witness placed the seeds between two petri dishes without treatment and preserved them until they were planted in the field.

The previous treatments were chosen for their role in stopping or reducing the effect of abscisic acid on seeds, as it inhibits the physiological activity inside the seed, encourages hydrolysis enzymes, and increases their effectiveness. Gibberellic acid treatment was also used because of its positive effect on the plant.

4 -Results:

5 -Geographical data for the studied areas: The following table shows the coordinates of the collection areas.

Table (1) Coordinates of collection sites

Location Region Height above sea level/m Longitude Latitude

Location	Region	Height above sea level/m	Longitude	Latitude
Al Marah	Al Nabek	1500	36°68' 06"	33°87' 80"

Qara	Al Nabek	2464-1200	36°44' 39"	34°09' 15"
Jabadin	Al Qatife	1500	36°30' 33"	33°49' 35"
Sasa'a	Qatana	1200	36°01' 18"	33°17' 03"
Ain Hour	Al-Zabadani	1480	36°08' 09"	33°46' 17"
Rencos	Al tall	2150-1650	36°23' 15"	33°45' 24"
Wadi Askar (Al-Rawda)	Al-Zabadani	1200	"360118	333911
Al saarukhia	Al-Zabadani	1600	360228	3363627

Figure No. (6): A map from Google Maps indicating the studied places

2 -Samples studied and place of collection:

sites were chosen for the study: Al-Marah - Qara - Al-Sarukhiya - Rankous - Jabadin - Wadi Askar (Al-Rawda) - Sasa' - Ain Hour. Of these, 3 species of the genus *Crocus* were collected in Table (1). One of the most notable results was confirmation of the presence of these species within the Damascus countryside governorate in the Syrian flora.

Table (2) Areas for collecting wild saffron samples

	Type	Date of collection		
<i>Crocus</i>	<i>crocus cancellatus</i>	11/1/2020	11/5/2019.	- Qara - Al-Sarukhiya Sasa' - Ain Hour Jabadin
	<i>crocus damascenus</i>	10/25/2020	10/31/2019	Al-Marah- Rankous
	<i>crocuse aleppicus</i>	11/5/2020	11/10/2019	- Wadi Askar (Al-Rawda) Ain Hour. Rankous

1-Classification indicators:

The morphological classification of wild saffron species collected from the previous sites was based on the following taxonomic indicators, Table:(3)

Saffron type	<i>C. cancellatus</i>	<i>C. damascenus</i>	<i>C. aleppicus</i>
The outer covering of the corm(Texture the color)	Coarse mesh fibers and tangled fibers light brown	Rough parallel fibers light brown	Smooth fibers light brown
Average Corm length/cm	2.5	2.5	1.5
Average corm diameter/cm	2	3.3	1
Corm shape	Flattened-globose	Flattened-globose	Sub globose
The presence of leaves at the flowers	No leaves	No leaves	Leaves appear with flowers
Average length of leaves/cm	8	8	6
Average number of sheets/sheets	4	4	3
Color of leaves	dark green	dark green	green
The presence of a white stripe in the center of the leaf	Present	Present	Present
Tepal shape	Elongated	Elongated	ovoid
Tepal apex shape	Acute	Rounded	Rounded
Color of the floral tube apex	Cream white	Creamy white with dark purple veins	Gray with yellow at the base of the petal
Average flower neck length/cm	5	5	1.3
The dominant color of the petal	violate	Very light violet	White with yellow at the base
The color of the lines and veins on the petals	dark purple	dark purple	Purple main vein at base of petal
Vein pattern	In an orderly manner	On the main veins	unavailable
Flowering time	until 11/24 4/10	until 11/24 4/10	until 11/25 15/10
Style of stigma branching	Branched 3 branches at the top	Branched 8 branches at the top	Branched with 8 branches at the apex

Average stigma length/cm	1.2	3.7	2
Stigma color	light red	Orange red	Orange red
Average number of fruits/vesicles	2	2	-
Average fruit length/cm	1.8	2.8	-
Average number of seeds within the fruit/seed	13.3	16	-
Average weight of 100 seeds/g	0.8133	0.8915	-
Fruit shape	fusiform	oval	-
Seed color	Reddish brown	Dark brown	-
Fruit color	Purple with purple stripes	light green	-

3 -Results: The morphological description of wild saffron species collected from the targeted areas can be summarized as follows:

5-1 -Botanical description of reticulated saffron:

A perennial herbaceous plant. The leaves are not present at the flowering stage, and appear immediately after the flowers. The average leaf length is 8 cm, and the average number of leaves is 4 leaves. It is dark green in color with a white stripe. Flowering occurs after the first rain in the fall. The flower is hermaphrodite and bears a pink spikelet. The average length of the flower neck is 5 cm. The color of the flower tube is creamy white. The sleeve is radial, the symmetry is tubular, and its pieces are similar and almost equal in size. The petals are elongated and the petal head is sharp. The dominant color of the petal is light purple with regular dark purple lines and veins. The stamens are triangular. The thread is short white. Its length is about a quarter of the length of the anther. The anther is yellow, strongly twisted, and the pollen is yellow. The female organ is composed of three carpels, and the lower ovary consists of three chambers located under the soil. It is surmounted by a light red pen branching into three main branches at the top. The stigma is of average length. 1.2 cm. The fruit is an oval, paper-shaped box with an average length of 1.8 cm. It opens ovately from the top through three purple-colored leaves with purple bands. The average number of seeds is 13.3 seeds, and the average weight of 100 seeds is 0.813 g. The seed color is reddish-brown.

The corm is spherical, flat, with a light brown color, its average length is 2.5 cm, and its average diameter is 2 cm. It is covered by several leaves, the outer part of which is composed of a network of coarse fibers, leaving rectangular or diamond-shaped spaces between them, which extend along

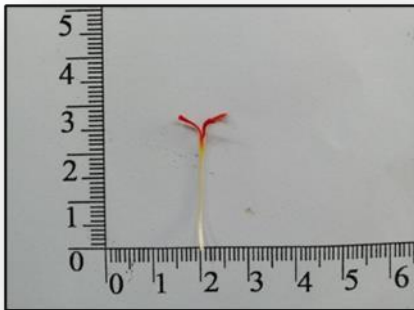
the length of the stem as coarse mesh fibers, and the inner part is intertwined fibers. A new stem appears every year at the base of the stem and above the old stem.



Flower



Parts of a flower



Stigmas



The whole plant



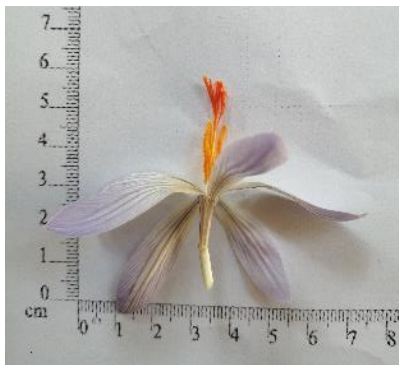
Plant in its natural environment

Botanical description of Damascene saffron:

A perennial herbaceous plant. The leaves are not present at the flowering stage, and appear immediately after the flowers. The average leaf length is 8 cm, and the average number of leaves

is 4. Dark green in color with a white stripe. Flowers take place after the first rain in the fall. The flower is hermaphrodite and bears a pink spikelet. The average length of the flower neck is 5 cm, the color of the flower tube is creamy white, the sleeve is radial, the symmetry is tubular, its piece is similar, almost equal in size, the petals are elongated, and the head of the petal is rounded, the dominant color of the petal is very light purple with the lines and veins on the main veins dark purple in color, the three-threaded stamens are white. Short, about a quarter of the length of the anther. The anther is yellow, strongly twisted, and the pollen is yellow. The female organ is composed of three carpels. The ovary is below three chambers, located under the soil. It is topped with a red-orange pen, branching into 8 branches at the top. The average length of the stigma is 3.7 cm. The fruit is an elongated, paper-shaped box with an average length of 2.8 cm. It opens ovately from the top through three leaves that are light green with dark brown. The average number of seeds is 16 seeds, and the average seed weight is 0.8910 g. The seed color is reddish brown.

The vine is spherical, flat, with a light brown color, average length of 2.5 cm and average diameter of 3.3 cm. It is covered by several leaves, the outer part of which is composed of a network of coarse fibers that leave rectangular or diamond-shaped spaces between them, and extend along the length of the stem as coarse fibers. A new vine appears every year. At the base of the stem and above the old vine.



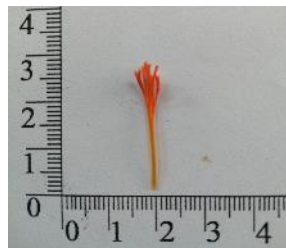
Flower



Parts of a flower



Plant in its natural environment



stigmas

Botanical description of Aleppo saffron:

A perennial herbaceous plant with leaves that appear at the flowering stage. Their average length is 6 cm and the average number of leaves is 4. They are dark green in color with a white stripe. Flowering takes place after the first rain in the fall. The flower is hermaphrodite and bears a pink spikelet. The average length of the flower neck is 1.3 cm. Color The flower tube is gray with yellow gradations at the base of the petal. The sleeve is radial. The symmetry is tubular. Its pieces are similar and almost equal in size. The petals are oval, and the tip of the petal is rounded. The dominant color in the petal is white with a yellow color at the base with a purple main vein at the base of the petal. The stamens are triangular, the thread is yellow. Short, about a quarter of the length of the anther. The anther is yellow and strongly twisted. The pollen is yellow. The female member is composed of three carpels. The ovary is below three chambers and is located under the soil. It is topped by a red-orange pen branched into 8 branches at the top. The average length of the stigma is 2 cm. The fruit is not present. Aleppo saffron has a short life cycle of 2-3 weeks and is not a seed producer.

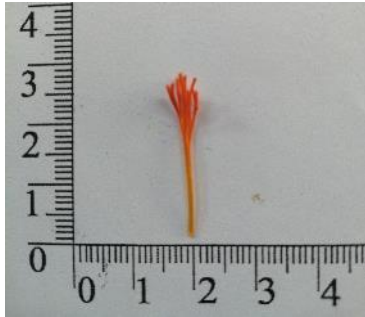
The corm is spherical, light brown in color, average in length, 1.5 cm long, with an average diameter of 1 cm. It is covered by several leaves, the outer part of which is composed of a network of smooth fibers that leave small spaces between them and extend along the length of the stem. A new corm appears every year at the base of the stem and above the old corm, but it is smaller. larger than the previous one.



Plant in its natural environment



Flower



stigmas



Parts of a flower

Germination rate:

The results in table () show that the germination rate of the wild species varied between the treatments and the species studied. This is a result of the response to the treatments. Treatment (1) gave the highest germination rate of 63%, significantly superior to treatment (3) with a germination rate of 17.08%, while the remaining treatments were without significant differences as well. As for the type of seeds, the differences were not significant. As for the interaction between the type of seeds and the studied treatments, treatment (1) was superior to the type of seeds, reticulated saffron.

C cancellatus gave a germination rate estimated at 73.33% on the type of seeds of the Damascus saffron type treated with treatment (1), and it also outperformed the two types of seeds treated with treatment (3), and the germination percentage in them reached (17.50 and 16.6%), respectively.

	1	2	3	4	mean
<i>cancellatus</i> <i>C.</i>	73.333a	0.00d	17.500c	5.000d	19.3182A
<i>C.</i> <i>damascenus</i>	56.667b	0.00d	16.667c	d5.000	19.5833A
	63 A	0.00 C	B17.08	C 5	
LSD5%	For seed type=21.99	For treatment=6.10		For interaction=5.91	

*Different lowercase letters indicate significant differences in the interaction coefficients.

**Different capital letters within a line indicate significant differences between coefficients.

***Different capital letters within the column indicate the presence of significant differences between the two types of wild saffron.

Conclusions and recommendations:

- 1 -The study confirmed the presence of the three species (*Crocus cancellatus* - *Crocus damascenus* - *Crocus aleppicus*) in the Damascus countryside governorate.
- 2 -Variation in stigma characteristics (length and branching of stigmas) in the studied samples of wild saffron.
- 3 -Propagation of wild saffron (reticulated saffron and Damascus saffron) through seeds, except for Aleppo saffron.
- 4- Deepening the study of Syrian flora.

Foreign references:

- 1- Al kade Imad, Al-Sabbagh Abdul Aziz, (2012), Plant Classification, Damascus University Publications, Faculty of Agriculture.
- 2- Al waraa hassan. Bashir, (1982), Seed coats, plant division science, Directorate of University Books and Publications, Faculty of Agriculture, University of Aleppo.
- 3- Atlas of the Flora of the Syrian Desert, (2008), Flora of the Syrian Desert, Arab Center for Studies of Dry Zones and Dry Lands (ACSAD),
- 4- Crocus (*Crocus* spp.) Descriptors for c Bioversity International, (2015), Bioversity International Universidad de Castilla-La Mancha Headquarters Calle Altagracia, 50 Via dei Tre Denari 472/a 13071 Ciudad Real 00057 Maccarese (Fiumicino) Spain Rome webmaster@uclm.es Italy bioversity@cgiar.org ISBN-13: 978-92-9043-999-8.
- 5- Engels, J.M. and M. Engelmann, (2002), Botanic gardens and agricultural gene banks: Building on complementary strengths for more effective global conservation of plant genetic resources. Plant Genetic Resources Newsletter, No.131:49-54.
- 6- Frison, A. E.; M., Mitteau and S., Sharrock, (2002), Sharing responsibilities for ex situ germplasm management. Plant Genetic Resources Newsletter, 2002, No.131:7-15
- 7- Hadid, Lama Nadim, (2016), A taxonomic study of species belonging to species of the order Liliaceae in the Jableh region, Tishreen University, Faculty of Science, Department of Plant Life Sciences.
- 8- Handa.S.S, Rkeh.D.D, Vasisht. K., (2006), Compendium of medicinal and aromatic plants, vol .2, (Asia).
- 9- Harpke, D., Peruzzi, L., Kerndorff, H., Karamplianis, T., Constantinidis, T., Randelovic', V., Randelovic', N., Jus'kovic', M., Pasche, E. and Blattner, F.R, (2014), Phylogeny, geographic distribution, and new taxonomic circumscription of the *Crocus reticulatus* species group (Iridaceae). Turkish Journal of Botany.
- 10- Jose'-Antonio Ferna'ndez • Omar Santana • Jose'-Luis Guardiola • Rosa-Victoria Molina • Pat Heslop-Harrison, (2011), The World Saffron and Crocus collection: strategies for

establishment, management, characterisation and utilisation *Genet Resour Crop Evol* 58:125–137 DOI 10.1007/s10722-010-9601-5 Evangelia Skourti and Costas A.

- 11- Mouterde P, (1966), *Nouvelle Flore du Liban et de la Syrie*, 3 Tomes+ Atlas- Dar Elmashreq, Beyrou, Liban.
- 12- Nahal, Ibrahim, (1989), Contribution to the study of biodiversity in Syria. *Aleppo University Research Journal*, issue twelfth.
- 13- Shahrli Mukhles and Al-Oubari, Khaled and Nabulsi, Ghassan Mawlawi, Bassam, (1995), *Priorities for the Conservation of Wild Genetic Resources in Syria*, Damascus, Syria.
- 14- Thanos, (2015), Seed afterripening and germination photoinhibition in the genus *Crocus* (Iridaceae) Department of Botany, Faculty of Biology, National and Kapodistrian University of Athens, Panepistimiopolis, Athens 15784, Greece, *Seed Science Research*.